THE MARINE REVIEW

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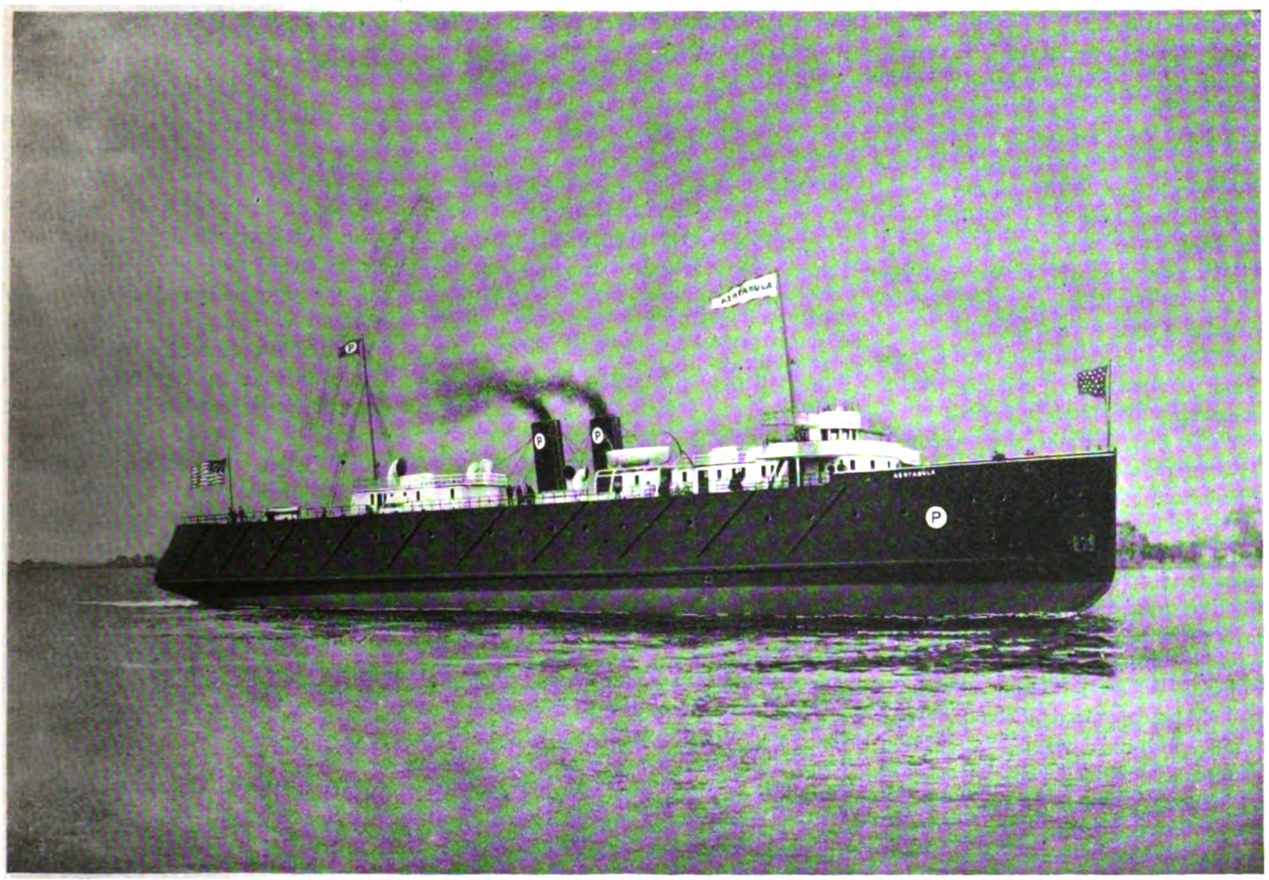
CAR FERRY ASHTABULA.

A recent test of the car ferry Ashtabula on the route between Ashtabula and Port Burwell was most satisfactory. The terms of the contract were in every way complied with. The contract called for a steady working speed of 12 miles per hour, with full load, and an emergency speed of 15 miles. Both requirements were fully met. At full load the draught was 14 ft. 10 in. The contract was that it should not exceed 15 ft. The speed test was made in a head sea with the wind blowing hard and it is thought that under favorable conditions the car ferry can make at least a half mile better time.



CAR FERRY ASHTABULA.

MARITIME LAW.

The following case, which we quote from London *Fairplay*, brings up the interesting question of the right of the owners to sell a vessel after it has been abandoned to the underwriters. "A case in which the owners of a vessel sold her after abandoning her to underwriters as a constructive total loss recently came before Mr. Justice Phillimore in the King's Bench Division. It is, I believe, unusual for owners to sell in such circumstances; but if, as in this instance, the underwriters interested refused to accept the notice of abandonment, the owners, driven in self-defence to act as if uninsured, may have considered that they had no alternative but to sell the vessel. Did they consult the underwriters before selling and inform them that the vessel would have to be sold unless definite instructions were forthcoming? What took place between the parties before the sale is not clearly set forth in the report I have seen, which in this and some other respects is defective. It would be interesting to learn the precise particulars, because on the face of it the case would seem to point to a short cut, namely, sale, where underwriters decline to accept abandonment; though I fancy that ordinarily owners would think twice before adopting such a course. Much would depend

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upon the facts, but these are only briefly given in the report alluded to, and unfortunately the judgment summarized in a few words, so that the points as they presented themselves to the judge are not available for guidance. The case was that of C. H. Watjen and others, owners of the steel sailing ship C. H. Watjen, against the Indemnity Mutual Marine Insurance Co. In October, 1902, the ship left New York with a cargo of petroleum, etc., for Japan via the Cape. She was insured in Germany for £8,000 on a valuation of £12,500. In May, 1903, the vessel not having been heard of and being considered overdue, the owners covered £4,800 in London, £2,000 of which, at 20 guineas per cent (on "open policy") would appear to have been placed with the Indemnity Co. Shortly afterwards, cable messages arrived, stating that the vessel had turned up in a dismasted condition near New Guinea in consequence of a cyclone. She was taken to Hall Sound and £1,250 salvage awarded, and she was then towed to Singapore at a cost of £2,000. Notice of abandonment was given. Plaintiffs stated that if the ship had been repaired she would be worth only £9,000, and that it would have cost £15,000 to repair her. The German underwriters paid a constructive total loss, their policies seemingly providing that they should pay such a loss when the cost of repairs equaled 75 per cent of the value. The ship was sold at Singapore for something under £3,000 to be used as a coal hulk at Thursday Island. One of the questions at issue was whether there was a constructive total loss, and, if so, whether the fact that the ship was sold by the owners after notice of abandonment had been given to and refused by the underwriters waived the notice of abandonment and consequently prevented the owners from recovering as for a constructive total loss. Mr. Hamilton, K. C., for the Indemnity Co., said that it was clear that all the damage was above deck. When the cargo was out it was found, he stated, that the hull was watertight, and only wanted a coat of paint to make it sound. It was absurd to say, he urged, that it would have cost £15,000 at Singapore to repair the ship, and he asked his lordship to view the estimates of plaintiff's witnesses on this point with suspicion. There was no evidence, he submitted, that the owners were acting as agents for the underwriters in selling the vessel, and he said that by selling her the plaintiffs waived the notice of abandonment. His lordship held that the vessel had become a constructive total loss, and that the notice of abandonment was not revoked or waived by the action of the ship owners. He found for the plaintiffs, and the figures were referred to Mr. F. C. Danson. There is no doubt that the judge gave one of his lucid judgments in this case, but his arguments are not put forward in the report. When a ship owner abandons his vessel to his underwriters he, in effect hands her over to them, and the question arises how he can afterwards see his way to sell property which he has thus, virtually, transferred. The notice of abandonment was refused, and it is to be presumed that the judge held that this restored the property to the ship owners. Were they then in a position to act as if uninsured? If uninsured they would not have had reason to issue a notice of abandonment; so that the two positions are not exactly on all fours. But setting all this aside the interesting question remains, What—where there is no valuation clause—is an owner to do when his notice of abandonment is declined and his ship is, as a matter of figures, though not perhaps of law, a constructive total loss? Must he solicit the instructions of his underwriters and be guided by whatever they may say, or is he free to act independently of them and sell the ship? If underwriters should insist upon repairs, though they might exceed the ship's value after repairs, or her insured value (if the valuation clause is included), must the owner repair?"

PORT OF GALVESTON.

Spent for harbor improvements, including jetties	$192,914
For Galveston channel	29,367
For government seawall and revetment	163,038
Construction of dredge Col. Miller	102,500
Total	$487,819

So far as work upon government projects at the port of Galveston is concerned, the two principal projects that have occupied the attention of the United States engineer's office the past year have been the Galveston harbor improvements and the Galveston channel improvements. The disbursements on these two projects at the end of the fiscal year, June 30, 1906, amounted to $222,281.18. These expenditures were made as follows: Galveston harbor improvements, $192,914.09; Galveston channel improvements, $29,267.09. The disbursements during the preceding fiscal year on all work, exclusive of work on fortifications, amounted to nearly $700,000. A much larger amount was spent in jetty repair work and the government extension to the seawall was in process of construction. The latter project was completed in October of last year, after which the rock revetment extending north from the end of the seawall to Avenue U, the north boundary of the Fort Crockett reservation, was taken up and completed in December. Disbursements on these projects amounted to $163,038.

The government, believing that it could do its own dredging in Galveston channel more advantageously than by letting it out by contract, last year let the contract for a large dredge. As soon as it was completed the dredge was put to work in the channel. Shortly afterwards, however, the funds available for the work were exhausted and awaiting an appropriation provided for in the sundry civil bill passed at the last congress, the Col. Miller, as it was named, was taken to Buffalo Bayou to do some work there. As soon as the money was available, in June of the present year, the dredge was taken back to Galveston and has been in operation ever since. Prior to the time the Gen. Miller was turned over to the government the dredge Texas City, one of the Bowers Southern Dredging Co.'s fleet of dredges, was furnished to the government for their use. The work was started early in September, 1905.

The channel between Thirty-first and Forty-fourth streets, the westernmost face of present westernmost slip of the Southern Pacific wharves, which at the close of the last fiscal year had been dredged under contract 200 ft. wide and 30 ft. deep, was during the year widened to 550 ft. and approximately 30 ft. deep. In addition to the work done by the government, the wharf company removed 76,377 cu. yds. from the strip 75 ft. wide immediately adjacent to the wharves, which the government does not dredge or maintain.

The dredge Col. Miller was completed under contract with the Bowers Southern Dredging Co., of Galveston, Tex., in February, 1906. Owing to the exhaustion of funds March 6, 1906, no more work could be done on this improvement until in June, 1906. The cost of the dredge was $102,500.

The greatest shoaling has occurred at the toe of the northern slope, where from sloughing in of bank and silt from the flats minimum depth of 23 ft. is now available. Here it has been dredged to 30 ft.

The connection of the pile and brush dike with Pelican island was completed during the year by the addition of 260 cords of brush and 249,099 cu. yds. of material excavated by the United States dredge Gen. H. M. Robert and deposited behind the dike. In addition 260 cords of brush and 136,570 yds. of material were used to reinforce low places in the portions

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of the dike previously completed. Of this yardage 36,000 cu. yds. were taken from the proposed channel.

The sum of $5,000 was allotted during the year from the appropriation for improving Galveston harbor, and, in addition, the sum of $45,000 has been allotted from said appropriation contained in civil sundry bill approved June 30, 1906. About 20 per cent of the projected yardage has been removed and about 30 per cent of the project area has had the project depth.

During the fiscal year the total expenses for the operation of the dredges Texas City and Col. Miller amounted to $29,367.

The project incurring the greatest expenditure during the fiscal year ending June 30, 1906, was that of the Galveston harbor improvements, under which head comes the jetty repair work. The government engineers estimated that the cost of repairing the jetties, which were severely damaged by the storm of Sept. 8, 1900, would be $1,500,000. Congress made an appropriation of $750,000.

With the exception of filling in of voids with small rip-rap, which has not yet been done, the repair of the north jetty was completed during the summer of 1905. On the south jetty operations commenced Aug. 20, 1905, and to close of fiscal year 30,836.70 tons of large rip-rap, valued at $106,078.25, and 9,682.16 tons of small rip-rap, valued at $29.724.23, had been placed and delivered between stations 251 and 348, practically completing the jetty between these two stations. Operations were suspended April 15, 1906, on account of frequent southeast winds at this season of the year, which interfere with operations of plant on the south side of the jetty, the north side being too shallow for carrying on the worth further.

Repairs to this jetty are completed for 75 per cent of its length. It is expected work will be completed within the next month.

The dredge Gen. C. B. Comstock excavated, removed and dumped from Galveston harbor 1,303,865 cu. yds. of material, the total money expended being $57,111.61. Of the amount dredged 507,610 cu. yds. of sand, clay and shell were dredged from the outer bar and 796,255 of sand and silt from the inner bar.

According to the last survey of the Galveston channel, there is a ruling depth of 30 ft. along the improved water front. Over the outer bar at the mouth of the jetties there was a minimum depth of 28½ ft., while at the inner bar a minimum depth of 27½ ft.

After the Galveston seawall was well under way pressure was brought to bear upon the government to extend this bulwark from Thirty-ninth to Fifty-third street, across the south side of Fort Crockett Reservation. An appropriation of $591,000 was made for this, and in August, 1904, the contract was let to J. M. O'Rourke & Co., the builders of the Galveston county sea wall. In the meantime the latter had been completed, and in December, 1904, the contractors started upon the work, completing it on Oct. 18, 1905. The contract price was $259,825. The contract for the revetment, extending north along Fifty-third street from the end of the seawall to Avenue U, the north boundary of Fort Crockett Reservation, was let a short time before the seawall was completed and simultaneously with its completion. I. Heffron & Son, which firm secured the contract, started work on the revetment. The total amount of rock placed was 8,673.59 tons. The contract price was $18,213.54, and the work was completed in December, 1905.

The original appropriation of $591,000 not only provided for the seawall, but for the filling of the reservation as well. It did not, however, provide for the filling of a triangular strip from Thirty-ninth street to Forty-fifth street, the eastern boundary of the reservation. This strip, which lies between the seawall and Avenue U, was deeded to the government in consideration of the wall being built. It is now government property, and the last congress made an appropriation of $159,000 for filling purposes. The North American Dredging Co., of San Francisco, was the successful bidder for the filling of all government property under the appropriation made, their bid being $383,425. This firm will utilize Offat's Bayou as a source of supply for material, and the machinery and plant is now being installed. The work will undoubtedly be under way within a short time.

The storm of 1900 badly damaged the three fortifications protecting this port and a sum of nearly $1,000,000 was appropriated for the rebuilding. The three fortifications protecting this harbor are Fort Travis, on Bolivar Point, Fort San Jacinto, on the extreme east end of Galveston island, and Fort Crockett, in the western part of the city. For four years the work of rebuilding has been under way, and in the fall of 1905, the report of the chief engineer of the war department made the announcement that the forts were practically completed. There is little doubt that all of the forts will be protected with a seawall and filling, similar to the plan now being carried out for the protection of Fort Crockett, but no appropriation has been made for Forts Travis and San Jacinto.

SAFE NAVIGATION.

Editor, MARINE REVIEW:—The subject of knowledge and skill in all that pertains to safety in navigation upon the great lakes has brought about a system of inquiry through your columns as well as establishing nautical schools at different points on the lakes, all of which are to a greater or less extent conducive to a higher plane of competency among those in charge of steamers, especially of the passenger and freight type, such as are expected to encounter all kinds of weather with as little delay as may be expedient under proper judgment and caution.

There is, however, an element of danger during thick weather that has not to my knowledge received the attention that its importance demands. I refer to currents that are frequently present and of which the navigator may only be apprised through disastrous results from being carried off his course by such currents or perhaps carried along in his regular course in excess of his perceptible speed while approaching a turning point, or point of destination. I have been informed that at different points on the lakes where steamers are plying nearly or directly across the lake on regular routes, that it frequently happens while crossing on the same course with no change in the compass or the wheelsmen, the vessel may be approaching the land several miles above or below the usual place. These currents may be the result of strong winds or even local winds that do not extend over the entire lake, which, together with the more obscure influence of a greater atmospheric pressure at one end of the lake than at the other, cause such current disturbances as often result seriously where only dead reckoning is available to the navigator. Such local currents are more marked on the ocean than upon our lakes, as evidenced in the investigation of the loss of the steamer Valencia on Jan. 22, 1906. The disaster was attributed to the fact that while running a distance of 477 miles the ship was carried 40 miles beyond her reckoning by a current setting in the same direction with her course.

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The weather being thick, she passed the entrance to the Straits of Juan de Fuca, went ashore on Vancouver Island, drowning 136 persons. Such experiences and the results of last fall's gale on Lake Superior leads me to believe that the greatest degree of safety is not assured in placing too much reliance upon a perfectly-adjusted compass and log (even if such there were), when the safety of your ship depends upon just when to change your course. If the weather is calm, check down and keep sounding; if a gale, face it, if possible, until your locality is established. Such practice I believe would at least reduce the number of casualities on the water. I am well aware that no set of fixed rules can be applied under all circumstances, so that the good judgment and skill of the master and officers are at the base of successful navigation after all.

JAMES STONE.

Cleveland, Sept. 19.

LLOYDS WRECK STATISTICS FOR 1905.

The interesting statistical summary of vessels totally lost, condemned, etc., just published by Lloyds Register, shows that during 1905 the gross reduction in the effective mercantile marine of the world amounted to 883 vessels of 792,354 tons, excluding all vessels of less than 100 tons. Of this total, 382 vessels of 527,978 tons were steamers, and 501 of 264,376 tons were sailing ships. The figures for the previous ten years are as follows:

Year.	Steamers.		Sailing Vessels.	
	No.	Tons (Gross)	No.	Tons (Net)
1895	310	372,463	927	433,815
1896	270	361,442	781	376,337
1897	293	398,207	752	328,593
1898	322	463,241	819	357,484
1899	330	469,621	666	313,887
1900	296	386,304	552	290,878
1901	268	366,584	538	295,984
1902	301	408,363	571	292,327
1903	326	479,081	596	300,722
1904	344	512,879	463	225,266
1905	382	527,978	501	264,376

Geo. S. Phelps Jr., United States engineer at Ashtabula, has laid down the law in regard to blocking the harbor with stray timbers, etc. He threatened to report violations of his orders to the United States district attorney.

LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

Shell plating. The shell plating edges on the side are all parallel to the sheer and the bottom plating edges are parallel to the keel. The girders in the bottom are also parallel to the center line which makes the bottom framing all square.

On the side the main deck and side stringers as well as the tank at side follow the line of sheer.

Fig. 56 shows the method of laying off a shell plate on the side of the vessel. The line AB is a level line and from this line the frames and butt laps are squared off. From AB is measured the distance 19 in., 18 in., 16½ in., 14½ in., 13 in. and 11 in., which determines the top edge of the plate. The plate being 67 in. parallel, the width 67 in. is measured on the frame and butt lap lines, which determines the width of the plate. The line for side stringer is put on parallel to the upper edge and 21 in. below same. The frame mold is applied as shown on frame No. 61.

After the frames are all marked the seam holes are then laid out with a space mold. The space between frames 63 and 64 shows the rivet holes marked but this is done after the frame holes have been marked so that any error may be detected in the frame spacing should the frame holes not agree with the holes in the mold for the seam holes. The hole for the intercostal flange is also laid off with a mold made for that purpose, the holes coresponding with the holes in the intercostal plate mold, D, Fig. 57. The lap butt mold is laid off to suit the three steam holes nearest the flange of the frame in this case.

This is an inside plate and in the

FIG. 56.

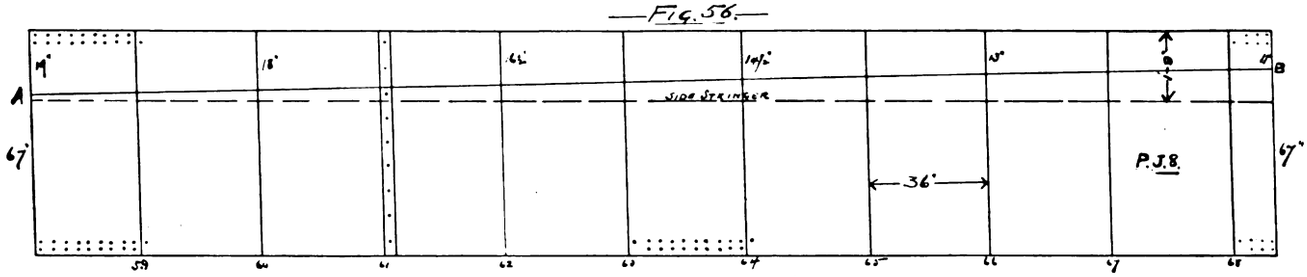

FIG. 57.

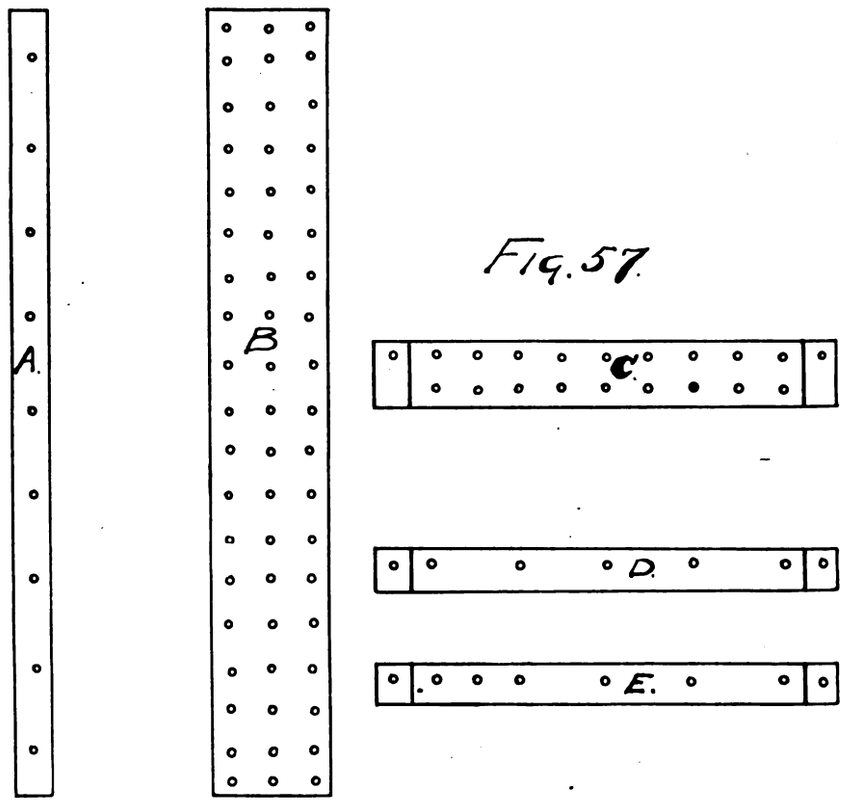

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Fig. 58.

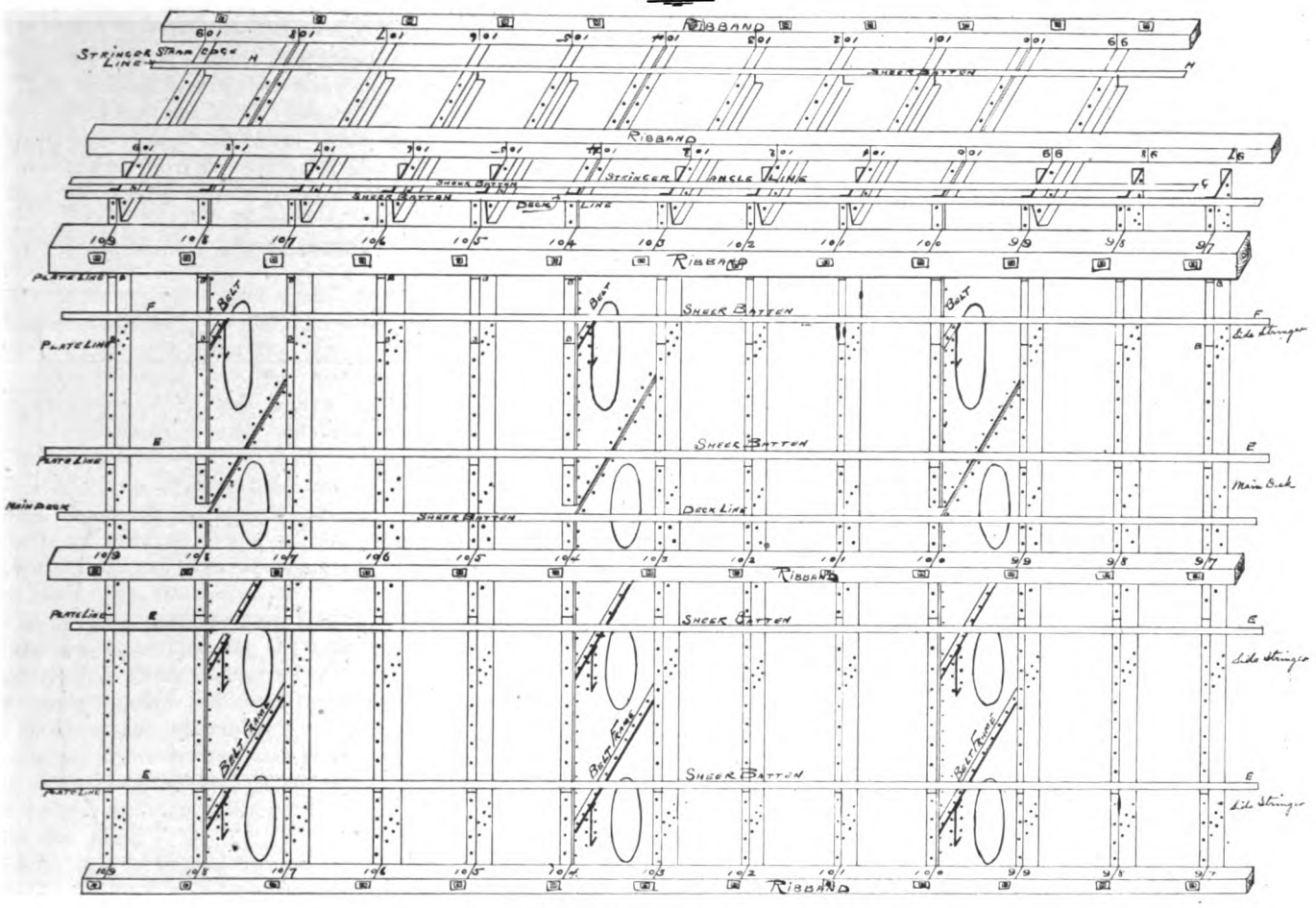
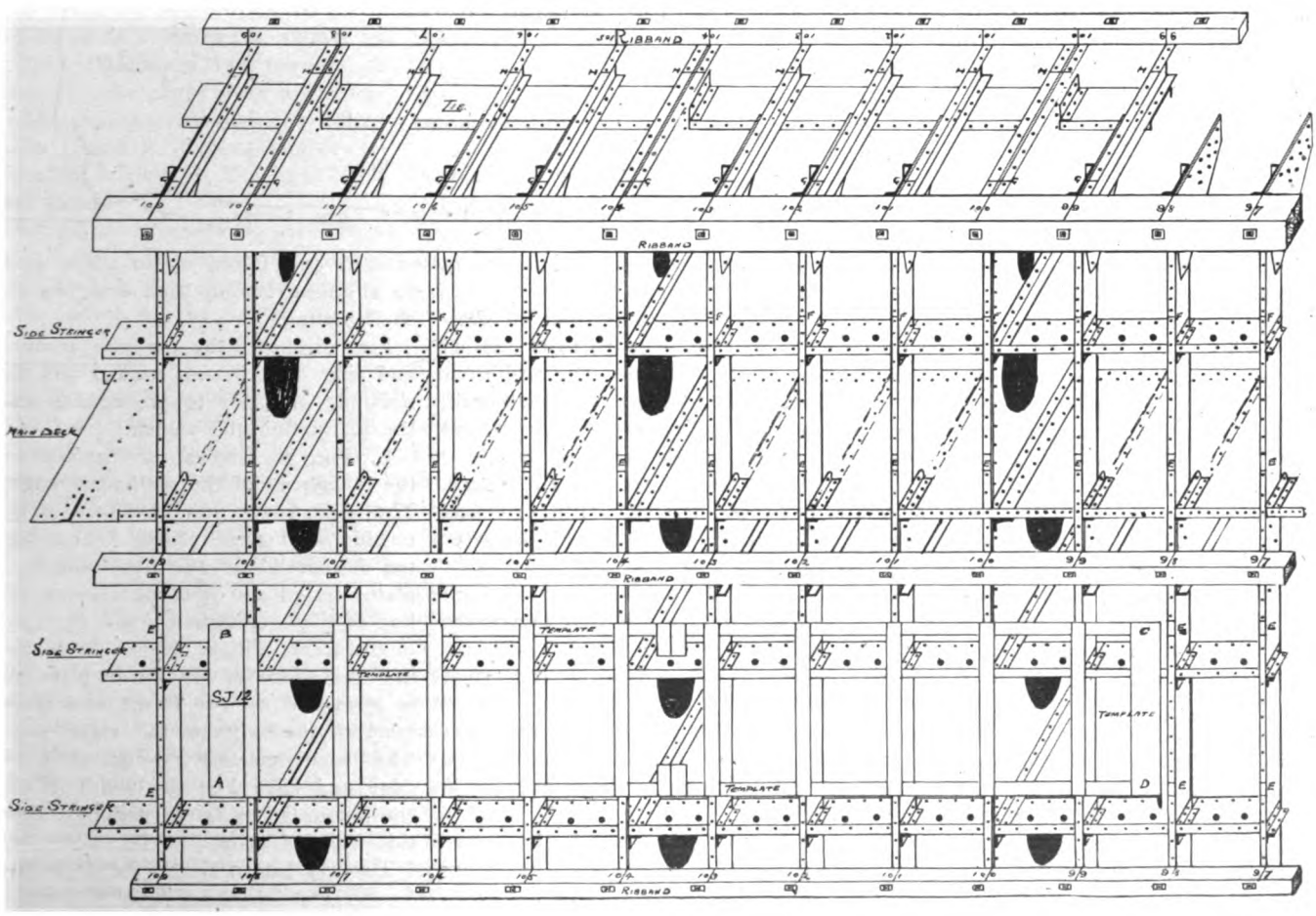


Fig 59.



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forebody the plate is run right up to the edge of the frame at the fore end and the after end of the plate runs over the flange enough to take the three holes in the seam, as shown.

The frames are all numbered from forward so that the fore end of the plate runs up almost to flange of No. 58.

No. 7 plate will lap on to No. 8 plate taking three seam holes as shown at frame No. 68. This arrangement forces the plate at the frame 58 inside its own thickness and assists in fairing up the shell seams in the lap butt space.

Fig. 57 shows the molds for the shell plate, Fig. 56.

A is the frame rivet hole mold, B lap butt mold, C seam mold, D side stringer intercostal mold, E side stringer intercostal mold where a lap butt comes in the space. The holes in these molds are arranged so that the molds can be turned over or end for end, so that there is no fear of any mix up.

D, Fig. 57, the mold for the side stringer intercostal, shows five holes being for seven-eighths inch diameter rivets. On the mold for the intercostals, Fig. 46, three-quarter rivets is considered, which accounts for only five rivets being in space D, Fig. 57.

This plate, Fig. 56, is an inside plate but all the holes are marked on the one side to save turning over at the punch machine. One lap and the frame holes will have a burr on the side where the material is laid together if care is not taken, but as a rule the holes are countersunk through the thickness of the plate which removes any roughness caused in punching.

All the side plates are marked similarly to Fig. 56 from H to M, molds being used to suit the different changes such as water-tight, bulkhead, inch riveted seams, stringer shoes and spar deck stringer angle riveting.

The bottom plating is all square, and the only change of the riveting is at the keel, which is inch diameter riveting.

The keel plate riveting is all inch diameter rivets, one side of the center keelson being made water-tight requires an extra mold for the rivet holes.

Molds needed for the keel are seam molds, two center keelson bar molds, liner mold, butts and frame rivet hole molds.

The bottom plating B, C and D are run parallel to the keel, and any changes made are done on strakes E and G.

When the frame space becomes longer than the frame spacing amidships, molds are made complete for the plates inway of same. The shell plating is completed from molds with the exception of two plates on each strake at each end.

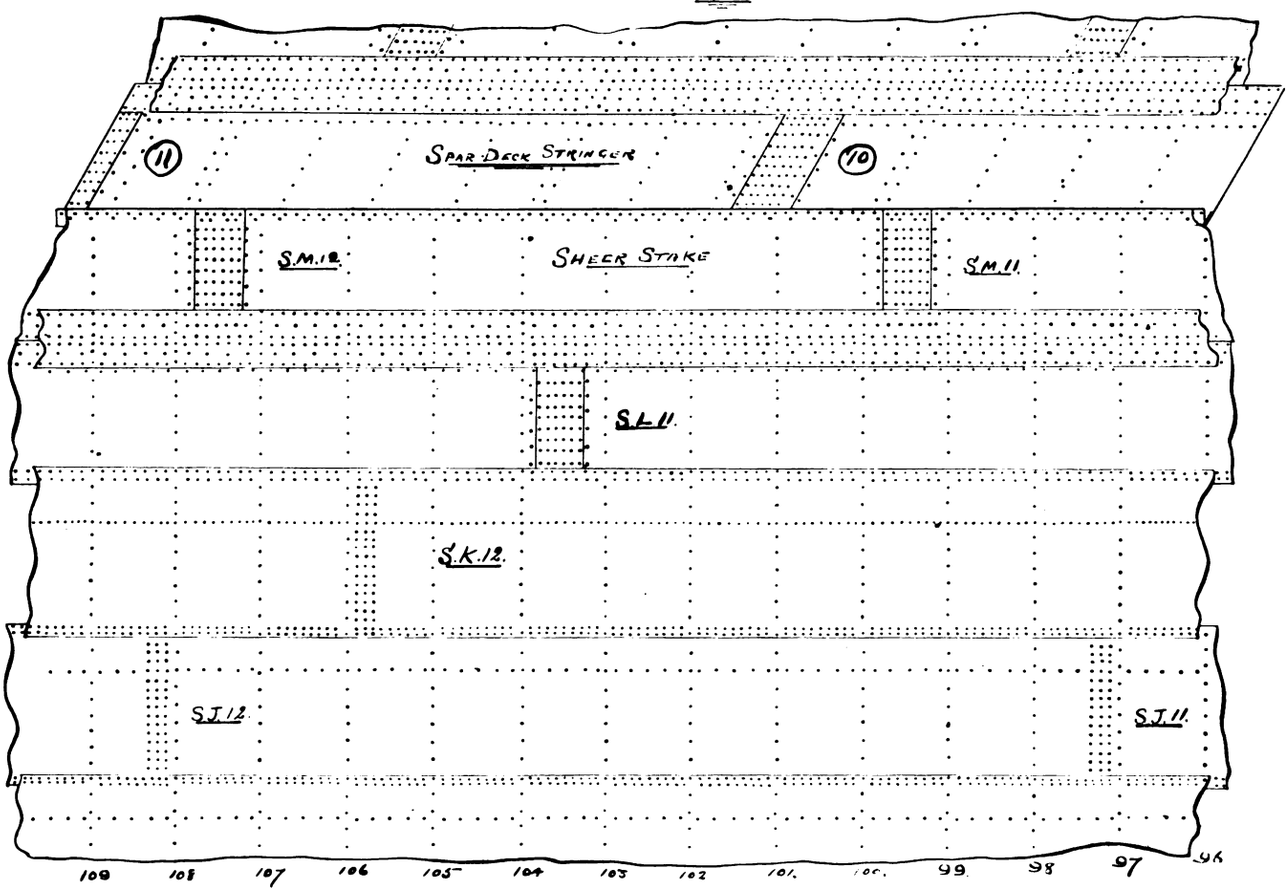
In Scotland the frames must be erected and faired up in place prior to anything having been done on the shell plating.

Fig. 58 shows the top side framing and spar deck beams erected and the ribbands on prior to proceeding with the plating on the vessel.

E, Fig. 58, shows the battens for the fairing up of the shell plate edges. The sight edges are the edges of the outside strakes of plating. This batten is faired up, then the width of plates tested and if found correct, the line of plate is nicked in on the edge of the frame with a chisel. From this line the width of the inside plate lap is measured on the frame and chisel marked similarly to the sight edge. The batten marked F, Fig. 58, is an edge and edge line the width of the continuous strap being measured from this line, as shown at B.

The top batten shows the deck line.

Fig. 60.



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This batten is faired up, and, as a rule, the under side of same is nicked in with a chisel on the frame. If the sheer batten is three inches wide, then the top of the beams would be three inches above the line. There is only one rivet hole punched in the beam, the other being drilled when the beam is at the proper height or true deck line.

The side stringers and main deck are treated similarly to the spar deck, only the line is put on the frame at the desired height, and the brackets for the main deck and under clips for side stringers fitted and riveted to same before fitting main deck plates and side stringer intercostals.

The sheer strake line is of great importance, and this line is not put on until the spar deck stringer plates and angles are all riveted.

The ribband near the ship side fairs up the beams at the side, the bolt being removed which connects the beam and frame together, allowing the beam to fit close to the ribband. If the hole is unfair when the beam is at the true deck line, the hole is rimed fair and bolted prior to drilling the extra holes for same.

Each beam is treated separately and fastened so that only one beam at a time is depending upon the ribband. On the spar deck, as shown, the edge of the flange of the stringer angle is faired up with a batten, as shown by G. This determines the fairness of the vessel's side at the deck line. The top ribband is heavier than the others as a rule, and is of considerable assistance in fairing up the spar deck on the outside.

Three ribbands would be used on a vessel of this kind on the spar deck, one at the side, one near the hatches and the other at the center of the ship.

Fig. 59 shows the interior work around the frames completed ready for the shell plating to go on with. The spar deck ribband at side, stringer plate and intercostal is removed. The top ribband as a rule is about one foot below the deck line instead of shown in line with deck, Fig. 59.

A B C D, Fig. 59, shows a template for an inside plate placed on the frames in order to copy the holes and shape of plate from same. The template is made in two pieces in order to facilitate the carrying of same and placing it in place on the vessel.

The rivet holes are copied from the frames with whitening. Pins are made the size of the rivet holes and by dipping them into a pot of whitening they can mark all the holes on the frame which comes on the template, in this case, eight.

The template is laid on the plate with the whitening marks on the under side of the template next the plate, just as shown on the plan. The plate is made damp under the whitening marks and by pressing the template on to the plate, which is done with the hand, giving the template a blow, the impression of the rivet holes is left on the plate. The plate is then all marked for the rivet holes which saves the turning over of same at the punch machine.

In order to get over the burr left on the holes at the frames by punching, the frame holes and one butt are countersunk through the plate. By this arrangement the puncher has no turning over plates.

The lap holes at E, Fig. 59, are all drilled after the plates are put in place. The outside plates are all reversed in the usual way.

All the shell plates on the vessel are templated from the vessel with the exception of the keel plates, which are marked from a mold similarly to the lake methods. To take a shell plate from the stock yard, 30 ft. x 16 ft. x 25 in., mark, punch, countersink, roll and erect on ship would cost eight dollars and twenty-five cents ($8.25). On the lakes the plate can be put on the vessel for two-thirds of that price.

Fig. 60 shows the plating and riveting of part of the vessel under discussion.

CHICAGO NAUTICAL SCHOOL.

The Chicago Nautical School will open its twelfth season of evening instruction in navigation and nautical subjects Nov. 1, under the superintendency of its founder, W. J. Wilson, formerly lieutenant in the United States Navy, but now chief of the hydrographic department of the great lakes with headquarters in Chicago. The rooms on the sixteenth floor of the Masonic Temple, where the classes have been held since their inception, have been re-engaged for the coming winter. Started as a labor of love on the part of Lieut. Wilson, the school is fast becoming an institution of no small importance on the great lakes. Eight hundred pupils have been enrolled since it started, and judged from the number that have already signified their willingness to attend, the present season bids fair to exceed all others in point of attendance. Many ship owners and masters now seek the graduates of this school for the first and second officers, wheelmen, etc., and Lieut. Wilson is constantly called upon to recommend men for these positions. An instance in this connection is the steamer W. G. Pollock, owned by the Robbins Transportation Co., whose captain, H. G. Hayberger, secured his first and second officers from the school after he had himself taken the course for his own benefit.

This year several important additions to the regular course are contemplated. Following several requests for information on wireless telegraphy, a complete wireless telegraphic outfit has been installed in the school and demonstrations and instructions will be given during the winter in this important maritime subject. Lieut. Wilson also hopes to include a series of lectures on meteorology, admiralty law and naval architecture by such competent authorities as Professor Cox, of the local weather bureau, C. E. Kremer and W. J. Wood, also of Chicago.

George W. Richardson, formerly chief machinist in the United States navy, and now in charge of the Cicero-Proviso waterworks, will have charge of the engineering and electrical studies in place of J. G. Kreer, who conducted these classes last winter. The classes for yachtsmen will open in November, and those for lake seamen at the close of navigation. Lieut. Wilson, however, is willing, in the meantime, to prepare students by mail for the evening classes should they be deficient in any of the subjects that will be taken up during the winter.

One of the most interesting quarterlies devoted to ship building was the *Mid-Tyne Link*, notwithstanding the fact that it was purely local, being devoted merely to the ship building industry at Tyneside, England. This periodical has now been developed into *The Shipbuilder*, and is intended to cover the ship building, marine engineering and allied industries of Britain. The initial number has an article by Mr. G. B. Hunter of Swan, Hunter & Wigham Richardson on the subject of shipping subsidies. Naturally he is opposed to them. The *Shipbuilder* is published quarterly by A. G. Hood, Falmouth Road, Newcastle-on-Tyne, England.

Capt. R. McFarland, Everett, Wash., has an inquiry for a steel steamer to carry from 1,000,000 to 1,500,000 ft. of Puget Sound lumber, the steamer to be in good order and of good class. Parties having such a steamer for sale are advised to write to him.

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THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

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SEPTEMBER 27, 1906.

MISFORTUNES ON THE PACIFIC.

It was a remarkable, and an unfortunate coincidence, that, as the Pacific Mail Steamship company's steamship Manchuria was being hauled off the beach on one Hawaiian island, on Friday of last week, her sister ship, the Mongolia should strike, and remain hard aground, upon another. These magnificent steamships, but two years old, and costing a total of five millions of dollars, were the finest American ships upon the Pacific, and their ill luck is a severe blow to the company that owns them, although there yet appears to be a good chance of saving them both. The wrecking vessels that successfully towed the Manchuria into Honolulu are now busily at work salving the Mongolia on Midway island, and they will doubtless succeed. It will then become necessary to get the two ships to San Francisco, where they can be docked and repaired—a job that will take a long time, the line meanwhile being sadly crippled, since the traffic carried by those fine vessels was enormous and steadily growing.

The impression seems so general that the Manchuria and the Mongolia were owned by the Pacific Mail Steamship Co., and in all news dispatches referring to them that statement is so repeatedly made, that it should be known that these two ships are owned by the Union Pacific Railway Co. which charters them to the Pacific Mail Steamship Co. A majority of the stock of the Pacific Mail is owned by the Southern Pacific Railway Co., and control of the latter is held by the Union Pacific.

The Pacific Mail has been paying for its two fine ships Korea and Siberia out of earnings, for the past six years, during which time it has paid no dividends. Those ships are now about all paid for, and it may have been the intention of the Union Pacific to sell the Mongolia and the Manchuria to the Pacific Mail as soon as the latter company was able to purchase them. We may say, in passing, that the rumor, current so long, that a Japanese steamship company had an option for the purchase of their trans-Pacific steamships, is emphatically and circumstantially denied by the officers of the company.

RULES FOR FISHING VESSELS.

Article 9 (governing lights and signals on fishing vessels) of the revised international rules for preventing collisions at sea, has now been put in force by Great Britain. It has also been adopted by the following maritime nations: Germany, Norway, France, Italy, Japan, Sweden, Netherlands, Denmark, Austria-Hungary, Greece, Belgium, Argentina, Portugal, China, Peru, Egypt, Venezuela, Siam, Guatemala and Costa Rica. The merchant fleets of these nations comprise about 30,000,000 gross tons, or over four-fifths of the world's tonnage. An act of congress will be necessary to mark the adoption of these rules by the United States and to permit the use of new lights and signals on American fishing vessels. The subject will be presented at the next session of congress. The advantages of uniform signals at sea are recognized by all. Practically every foreign vessel visiting American waters will be assisted with the new code of lights for fishing vessels and will know what course to follow when such lights are seen. Partly offsetting these advantages are the disadvantages of changing from any existing system to a new system. On the sea American fishing vessels under way are now carrying the ordinary colored side lights, and if steamers, in addition the white mast head light or white range lights. On harbors or inland waters they carry a red light above the white light. They do not carry a light especially designed for their protection indicating their occupation and the direction or kind of gear, as proposed in the new rules. The lights proposed are nearly all new to American fishing vessels, but as they are the accepted lights of four-fifths of the world's tonnage, it would seem wise to adopt them.

THE PRIZE CONTEST.

The Merchant Marine League officers state that applications are coming in in every mail from students in high schools, technological schools, colleges and universities, desiring their names to be registered as contestants for the four prizes of $400, $300, $200 and $100, offered for the four best essays on "How to Build Up Our Shipping in the Foreign Trade." Massachusetts leads the lists in the number of applications received, but New York is a close second. Students in Pennsylvania, Indiana, Iowa, Michigan, Missouri, Ohio, Texas, Alabama, Florida, are registered, and the league is sending its documents to all who apply for them.

One rather remarkable thing is that not a student in the city of Cleveland, the home of the league, where there are several high schools and universities, has, as yet, asked to have his name registered as a contestant.

The government dry dock and storage houses at Buenos Ayres were destroyed by fire last week, entailing an aggregate loss of over $2,000,000.

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AT THE HEAD OF THE LAKES.

Duluth, Sept. 24.—The movement of ore during the week of Sept. 14-21 was characterized by large gains over last year and unless a large falling off develops in the next two months, a circumstance of which there is no reasonable probability, a total shipment of 36,500,000 tons for the season is assured for already the Minnesota mines have made a gain of more than 2,000,000 tons. The loading of ore from the new No. 4 dock at Duluth was inaugurated during the past week when the steamer A. B. Wolvin took part of her cargo there. The lack of incandescent lights in the pockets has prohibited night work and the real use of the dock up to this time but beginning with tonight it will be used steadily. Something in the way of record loading will probably be attempted in the near future. The shipment figures for the seven days from Sept. 14 to Sept. 21 are as follows: Two Harbors, 271,682 tons; Duluth, 470,121 tons and Superior, 196,770 tons, a total for the week of 938,573 tons. The comparative statement for the same period last year was Two Harbors, 228,507 tons; Duluth, 236,941 tons and Superior, 162,791 tons, an aggregate of 628,239 tons. This indicates a gain for the week this year of 310,334 tons. The total shipment from the northern ranges for the year to date is 17,833,601 tons against 15,737,456 tons last year, a gain of 2,096,145 tons. The season shipment last year was 34,353,456 tons. If the present rate is maintained and the lower ranges do not fall back too seriously it will be seen that the statement above is very probable.

The new Missabe dock has the same number of pockets as the others at Duluth, 384 in number, but it is five feet higher which makes the pockets larger and gives a greater storage capacity. The No. 4 dock will hold 119,274 tons as compared with 80,640 tons the capacity of the No. 3 dock which is the next largest in size. At present but half of the dock has been completed ready for use. The new structure also differs in the style of spouts used. They are 30 feet 1½ inches long as compared with 27 feet 9 inches, the length of the old spouts, and are broader and shallower at the top, a design which will give the ore a better chance to run freely.

In the grain trade the stocks of wheat at Duluth elevators are growing with unusual rapidity. During the past week a million tons more wheat was received than was shipped and in the first two days of this week 1,300 cars were received which is close to another million and a half. Shipments are coming in with record breaking rapidity for this time in the season and the trade could use more boats than are available. The rate still remains where it bids fair to continue for some time, at 2½ cents to Buffalo. The figures for the past fourteen days are now available for comparison.

	Receipts.		Shipments.	
	Sept. 15	Sept. 22.	Sept. 15.	Sept. 22.
Wheat	1,868,767	2,487,553	1,221,176	1,496,617
Corn ..	6,656	7,129		
Oats ...	123,110	176,113	119,699	52,275
Barley .	485,692	541,454	183,056	427,636
Rye	22,410	17,316		25,000
Flaxseed	103,984	309,573	164,157	21,530

The coal situation is not much changed. The tonnage handled is smaller than it should be, only 188,720 tons being received at the three ports at this end of the lakes. Over 123,000 tons of this was received at Superior. The quantity received at Fort William has been much below the needs of the territory supplied from that port and the prospect is that coal shipments will be dragged out till late in the fall. Boats are obtaining prompt dispatch in unloading at this end and cargoes are readily handled on the docks. Domestic shipments are still somewhat slow.

The new lumber dock of the Northern Pacific, mentioned elsewhere in this issue was used for the first time at the beginning of this week when the lumber boat Goshawk was placed alongside to take a cargo. Lumber shipments are continuing active and the fall movement promises to take care of the stocks at this end without difficulty.

The steamer Edenborn left Duluth for the lower lakes on Saturday. She carried 700 tons of ore, placed in her hold so as to aid in holding the break together. The steamer Bunsen took her as far as Two Harbors from which point she left this morning, Monday, in tow of the Mariska. Capt. W. W. Smith is in charge of the Edenborn and she will be taken down by way of the islands and the portage. It is thought now that she will be repaired in time to carry ore before the close of navigation.

NEW LUMBER DOCK.

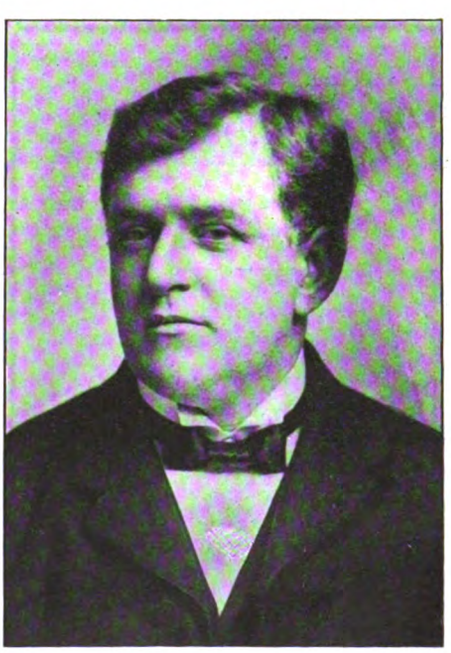
The most important improvement in the Duluth harbor so far as the lumber interests are concerned at present, is the approaching completion of the Northern Pacific's new lumber dock. The dock is not only located at a point of particular advantage on the inner side of Rice's Point, near the junction of all the roads entering Duluth, but, with the exception of the Duluth, Missabe & Northern log dock, is the only one at this port where the lumber may be loaded directly from the train on to the boat. Heretofore the D. M. & N. dock has been taking care of the Northern Pacific's lumber to a great extent, and the new structure will fill a big need. The dock is 800 feet long and 26 feet wide, built of 9 x 18-inch timbers, and resting on 45-foot piles. Two parallel tracks traverse the entire length of it, and it is expected that six boats may be loaded simultaneously, three on a side. The water alongside is 20 feet deep.

FREIGHT SITUATION.

No change is noted in the freight situation. Ore, coal and grain rates are steady, reasonable dispatch marking all trades. Ore has been moving fairly well, the dispatch at upper lake ports being better than ordinary. The diversion of cars has made the receipts of coal at Lake Erie ports somewhat less though small boats have no trouble in getting cargoes. The grain movement during the past week has been light.

MR. JAMES INMAN.

Mr. James Inman, chief engineer of the whaleback steamer Alexander



JAMES INMAN.

McDougall, began his career as a tug fireman in Chicago. Among the steamers which he has had are the Bulgaria, Caledonia, Maryland and John W. Gates.

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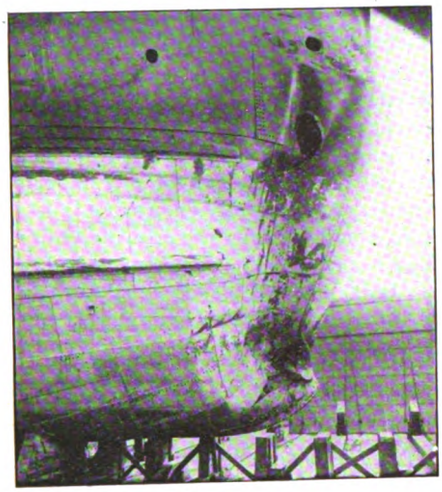
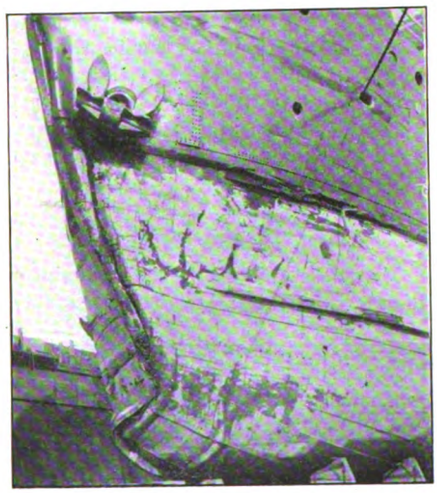
STEAMER URANUS.

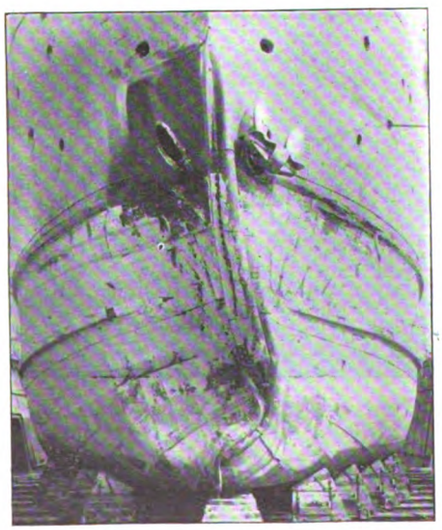
The photographs accompanying this article show the damage to the bow of



the steamer Uranus which sunk the steamer Gov. Smith. These photo-



graphs reveal the great damage that a wooden ship can do to a steel ship when



the two come in contact. The Uranus was taken to the Ecorse yard of the Great Lakes Engineering Works, where she was put in a floating dry dock. Her bow was so badly twisted that frames and plating had to be taken off and an entire new stem forged.

AROUND THE GREAT LAKES.

Keel for one of the Gilchrist steamers has been laid at the Bay City yard of the American Ship Building Co.

The new steamer Daniel J. Morrell, of the Cambria Steel Co.'s fleet, left Bay City, Sept. 24 on her maiden trip.

The steel tug Robert Johnston was launched from the yard of Johnston Bros., Grand Haven, Mich., last week.

The steamer Turret Cape is in dry dock at Lorain for repairs to her bottom plates, caused by striking in the Welland canal.

Announcement has been made that a new light house and fog signal station at Racine Reef will be placed in position on Oct. 6.

The owners of the steamer Packard which was sunk by striking the sunken schooner Armenia, have not as yet decided to raise the vessel.

Vessel masters are advised to use the new cut in St. Clair Flats while downbound. It is desired to use the old canal for upbound traffic exclusively.

M. Sullivan, dredging contractor, has completed the blasting of the city's portion of the channel at Sandusky, thus giving a 21-ft. channel to the Hanna docks.

The steamer Norman B. Ream, of the Pittsburg Steamship Co.'s fleet, built at the South Chicago yard of the American Ship Building Co., went into commission Sept. 22.

Capt. John Gallagher has qualified as master of the steamer George C. Howe. Capt. Frank C. Pratt, who was in the Howe, will bring out the steamer J. S. Dunham building at Bay City.

The new steamer J. H. Sheadle, building for the Cleveland Cliffs Iron Co., will be launched from the Ecorse yard of the Great Lakes Engineering works at eleven o'clock next Saturday morning.

The license of Capt. D. Bethune Elsey, master of the steamer Charles A. Eddy, which was burned in Lake Michigan, has been suspended for carrying passengers on the Eddy without a license.

The wooden schooner Constitution owned by Runnels & Sinclair of Port Huron, sank at the dock of the Kelley Island Lime & Transport Co., Kelley's Island, this week. She had taken on a cargo of stone, which proved too much for her.

The steamer Madagascar while en route to the Atlantic coast was attached in the Welland canal by the Hackett Wrecking Co. of Amherstburg, Ont., on a claim of $500 for work upon another boat owned by the owners of the Madagascar.

The license of Capt. Daniel Warwick, master of the steamer Mills, was suspended for its life which is until next March, because passengers were carried on the Mills without passenger license. The Mills was sunk in collision with the steamer Milwaukee in St. Clair river two weeks ago.

The steamer George T. Hope which was wrecked two years ago and abandoned by the underwriters, has been sold to M. Galvin of Buffalo. The Hope will be taken to Algonac for repairs. She was last operated by Mitchell & Co., but for the past two years has been beached in the west breakwater at Cleveland.

The 10,000-ton steamer building at the Lorain yard of the American Ship Building Co. for the Pioneer Steamship Co., of which Capt. Charles L. Hutchinson of Cleveland is manager, will be named Dan R. Hanna. The new steamer will be launched next month.

Capt. Charles Smart, of the barge Matanzas, was found to be mysteriously missing from his boat on Friday morning last. He had boarded the barge about eleven o'clock the night before. His hat was found on board but his bed had not been occupied. The mystery was cleared up on Sunday by the finding of his body in the river at Ashtabula. The right arm had been torn off near the shoulder by a propeller wheel.

The steamer H. B. Tuttle, which was beached off Marblehead, was repaired, floated and taken to Sandusky. After she had been moored to the B. & O. docks, the stern of the Tuttle broke aft of the boilers, and the steamer sank. The Tuttle is owned by Capt. C. E. Benham, of Cleveland, and is not insured. She is 179 ft. keel, 31 ft. beam and was built in 1871. She was bound for Sarnia at the time with a cargo of coal.

Firemen are causing an unusual amount of trouble this season. The steamer C. B. Hill, formerly the Anchor liner Delaware, sprang a leak in Lake Erie Sunday night, and the fireman refused to work further on her, claiming that she was not seaworthy. The Hill was forced to stop at Detroit. Capt. Coleman said that the boat was leaking slightly but was in no danger and that none of the crew except the fireman had complained.

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The steamer Henry Steinbrenner was inspected at Ashtabula last Sunday while unloading at the P. Y. & A. King's dock.

Herbert Finigan and Andrew R. McLeod are sailing on the Livingstone this season, with Capt. James Doner, as first and second mate, respectively.

Otto Fehmer, who is now mate of the steamer William P. Snyder, formerly sailed with Capt. Henry Peterson and will most likely go with him when the new boat comes out next spring.

When the steamer William P. Snyder was fitted out last spring, a bust picture of the man in whose honor she was named, was hung in the commodious observation room. Mr. Snyder presented the boat with a set of hunting pictures, and they hang in the passengers' quarters.

Within the next twelve months, it is freely predicted at Ashtabula harbor that the marine interests will be on the boom. New men are coming to the harbor to engage in business, and the prospects look exceedingly bright.

Geary & Kelley, two practical boiler makers, have started in business at Ashtabula harbor, catering to the marine trade almost exclusively. They manufacture boilers, tanks and stacks and do ship repair work above the water line. They are located at Market and High streets.

The Lake Shore & Michigan Southern Railway Co.'s new steel tug for use in the lake front improvements reached Ashtabula last week. She was built at Ferrysburg and is named after J. P. Manning, the "grand old man" of Ashtabula harbor.

The steamer Edwin F. Holmes, of the Hawgood fleet, has worked herself into the greyhound class. She left Cleveland Saturday, Sept. 15, at 9 p. m., reached Ashland, Tuesday, at 4 a. m., left there at 2 p. m. the same day and reached Ashtabula at noon Friday, Sept. 21. She lost four hours on account of smoky weather.

THE GEORGE W. PERKINS AND HENRY STEINBRENNER WEDGED IN THE SAULT STE. MARIE CANAL IN ATTEMPTING TO PASS AT ITS NARROWEST PART.

Alfred Poole, of Grenadier Island, Alexandria Bay, who is watchman on the steamer G. Watson French, fell into the hold last Sunday night and miraculously escaped death by going head first into a pile of soft ore. The only injury he sustained was a lacerated tongue, caused by his teeth going through it.

Capt. C. Diefenbach, wrecking master for the Port Huron Transportation & Wrecking Co., of Port Huron, put in at Ashtabula last week with three pontoons used in raising the Lake Erie Dredge Co.'s dredge, sunk off Dunkirk, N. Y. It took twelve working days to get the dredge up, but 120 days elapsed from the time work was first started. The steamer Mary Groh and the tug Home Rule, under Capt. Fred Trotter, towed the pontoons.

Now that winter is growing near and the "big wages" are about to begin, the rough element among the ordinary and able seamen are anxiously watching a chance to ship for the balance of the season. This is particularly evident at Ashtabula. The men have lain around all summer, but they now want to get busy.

Martin Hall, who is oiler on the steamer Queen City, is one of the younger generation of sailors who hold down one boat all season. He started firing on the McDougall three years ago, and rode on her for two seasons, laying her up the second season as an oiler. Since then he sailed on the Gen. Orlando M. Poe and he is now on the Queen City.

John McGonagle, superintendent, Wyandotte yard of American Ship Building Co., is very sick and has gone to Mt. Clemens to recuperate. Mr. McGonagle has been in charge of work around the lakes since steel work was commenced in Wyandotte. He came from England with the first importation of steel ship builders to Wyandotte and he has since been connected with Bay City and Buffalo at times during a period of 30 years. He is a capable steel ship builder being connected with the new methods on the lakes and is very well known throughout the lakes.

Capt. John Massey, master of the steamer G. Watson French, had just mailed a letter to his brother, Capt. James Massey, at Ogdensburg, when in Ashtabula last Sunday, and he was about to return to his boat when he received a letter from his mother telling him that Capt. James had died from the effects of typhoid fever. The deceased had sailed in earlier days as mate with Capt. John, and for thirty years he had acted as a pilot on the St. Lawrence river. Two of his children are also sick with typhoid. Capt. James Massey is also a brother of Capt. Sam Massey, of the steamer John Stanton.

The barge Manila, which went into dry dock at the yard of the Toledo Ship Building Co., Toledo, O., on June 16, left the dry dock on Sept. 13. Meanwhile the ship building company removed from the shell and tank top, 470 plates. Every plate came up from the bottom up to the bilge, and a few of the bilge plates. About three-fourths of the lower frames were removed and half of them replaced with new ones. The company had from 400 to 525 men working on her continuously since she went into the dock. After leaving the dock she went under the shears to have her main mast removed, and was then fitted with a rudder forging from the Cleveland City Forge & Iron Co.

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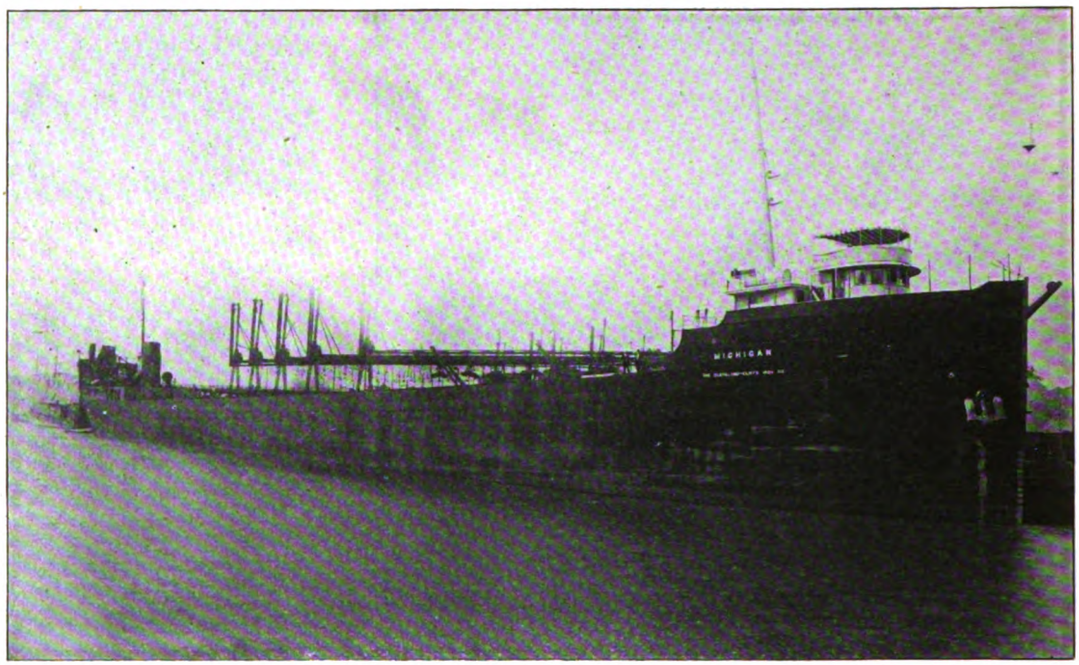
STATE OF OHIO STRANDED.

The passenger steamer State of Ohio of the Detroit & Cleveland Co.'s fleet stranded on Rattlesnake Island on Thursday morning last in a dense fog while en route from Toledo to Cleveland. Her sister ship, the City of the Straits, on the opposite route, was scheduled to pass the point about an hour later and as she did so, the Ohio signaled her and transferred her passengers to the Straits, which took them back to Toledo. Rattlesnake Island lies directly north of Put-in-Bay and is about one mile west of Middle Bass. Examination showed the Ohio to be out 5 ft. 4 in. forward and firmly on the rocks back to her paddle boxes. Capt. Cyrus H. Sinclair, representing the underwriters, put four tugs at work on her, but they were unable to move her a particle. It became clear that she would have to be jacked off the rocks. At a conference of the Detroit & Cleveland line it was decided to abandon the steamer to the underwriters. Bids were solicited from the various wrecking companies and contract for raising the steamer awarded to the Great Lakes Towing Co. The tug Favorite, under command of Capt. Alex Cunning, one of the most successful wrecking masters of the lakes, was ordered to the scene. Capt. Cunning made an examination of the steamer on Monday. He decided to lighten the steamer before attempting to lift her. The State of Ohio was built in 1880 at the yard of the Detroit Dry Dock Co. at Wyandotte. She is an especially seaworthy craft, built of iron, but is somewhat smaller than the usual type of paddle wheel steamer on the lakes, being 225 ft. long, 32 ft. beam and 22 ft. deep. Her original name was City of Alpena. She is still on the rocks, and her release will be attended with more than ordinary difficulty.

ANALYZING LAKE WATER.

Investigation has been undertaken by the chemists of the hydrographic branch of the United States geological survey which has for its object the determination of the quality of the water carried by the great lakes and the amount and kinds of mineral matter held in suspension, its fluctuations with different seasons and the changes which water undergoes in its journey from the head of Lake Superior to the St. Lawrence river. With this in view, arrangements have been made for the monthly collection of samples of water from each lake and the shipment of the samples to the laboratory of the survey at Washington where a complete mineral analysis is to be made. Samples of water are taken at Sault Ste. Marie, Straits of Mackinac, St. Clair river and Niagara river.



STEAMER MICHIGAN, OF THE CLEVELAND-CLIFFS IRON CO.'S FLEET.

This great vessel has two sisters, one of which, the J. H. Sheadle, will be launched at the Ecorse yard of the Great Lakes Engineering Works on Saturday next.

The Civil Service Commission announces an examination on Oct. 17 for the position of fireman on the steamer Poe, Fort Barancast, Fla.; fireman, steamer tug Gibben, Fort Screven, Ga.; steamer General Timothy Pickering, Fort Dade, Fla. Examinations are by mail, application for blanks to be made to the Civil Service Commission, Washington.

E. K. Young, who has been steward on the steamer James Laughlin all season, got off her on the last trip to Ashtabula. Mr. Young lives at Honey Creek, Wis., where he owns a 28-acre farm. He was proprietor of a Milwaukee hotel for several years and only sails for the pleasure of it.

The Dominion government has built at its ship yard at Sorel, Que., a steamboat, the Rouville, for use in Hudson Bay, by the Royal northwestern mounted police. The Rouville is 130 ft. over all, 96 ft. long, 26 ft. beam and 13 ft. deep.

Plans are being designed for the construction of two new ferry boats to run between San Francisco and Oakland.

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AMERICAN BOILER MANUFACTURERS' ASSOCIATION.

The eighteenth annual convention of the American Boiler Manufacturers' Association was held at Hotel Schenley, Pittsburg, last week. Col. E. D. Meier, of the Heine Safety Boiler Co., of New York, as chairman of the committee on uniform boiler specifications, presented the report of that committee. The report rehearses the progress made during the year in the conference with the Association of Steel Manufacturers regarding standard specifications as recommended by the American Boiler Manufacturers' Association and states that while the Association of Steel Manufacturers is perfectly willing to uphold the action of their committee so far as the agreement with the American Boiler Manufacturers' Association is concerned, they hesitate to make this applicable to the general trade, thus emphasizing the fact that in matters of improvement in boiler manufacture the A. B. M. A. stands in the lead. In February, 1906, Chairman Meier was present at a committee meeting of the A. A. S. M., in Washington, when a call was made on the Board of Supervising Inspectors, the subject of boiler materials thoroughly discussed before them, many of the points made receiving favorable consideration and being afterwards embodied in the revised rules of that board. Col. Meier's report states that the American Society of Testing Materials continues to show a strong and friendly interest in the work of the A. B. M. A. and on their invitation he had made a report to them in the matter of boiler materials last June. Several visits had been paid by Col. Meier to Mr. Herbert K. Smith, deputy commissioner of the Bureau of Corporations, Department of Commerce and Labor, in Washington, the last one on the 11th inst., who assured him that the department had concluded it would be impossible to pass the bill on the lines formerly recommended by this committee owing to there being so many diverse interests to reconcile; but he has taken up individual sections and succeeded in having some important amendments made. Referring to the question of the value of different rivet joints, Mr. Smith had expressed willingness to aid in recommending the section referring to same for amendment, and double riveted and triple riveted butt seams will be recognized by the law. The amendments to the various sections as passed by the last congress were in the hands of the government printer at the time of Col. Meier's visit to Mr. Smith, who has since forwarded copies to Col. Meier, one of which he showed at the convention (being form 800, Department of Commerce and Labor, Laws Governing Steamboat Inspection Service, edition July 17, 1906.) Col. Meier commended the advice of Com'r Smith as sound, and congratulated the association on the hearty good will and co-operation on the part of the Department of Commerce and Labor and of the Board of Supervising Inspectors. A new regulation in the department authorizes the Secretary of Commerce and Labor to call at any time an executive committee of the Board of Supervising Inspectors to advise with him, or his direct representatives, in regard to necessary changes or adjustments in the regulation. By this means local conditions can be met by a small executive committee called from the supervising inspectors of the districts immediately concerned. Their action when approved by the secretary has the force of law until the next meeting of the Board of Supervising Inspectors. In urgent cases, therefore, our members can make an appeal to the secretary for prompt action looking to relief, with the assurance that if the case is of sufficient importance and is properly and clearly presented it can be acted on upon short notice.

In connection with the foregoing report, a feature that was much appreciated was an informal talk by General George Uhler, inspector general of the Steamboat Inspection Service, his remarks evidencing that he took a very strong and intelligent interest in the work of the committee. The committee had all along felt that the co-operation of the Board of Supervising Inspectors was necessary to the ultimate success of their labors, and while it has had such co-operation in the past, there have been, naturally, frequent differences of opinion in regard to methods, although the aim of both the bureau and the A. B. M. A. has been essentially the same, namely, the improvement of the steam boiler practice in the United States. This improvement has been sought for by the association because naturally ordinances of cities, counties and states governing the construction of boilers for stationary purposes follow along the lines laid down by the federal authorities, and thus uniformity and excellence in boiler practice depends in a large measure on such federal regulations. While the American Boiler Manufacturers' Association in the past has had as its guests, and to take part in its discussions, local members of the Board of Supervising Inspectors, as well as local boiler inspectors, on no previous occasion has the head of the service taken such a direct practical part in the discussion, and General Uhler's attitude of continued interest and co-operation in the work of the A. B. M. A. is looked upon as certain to bear fruit. That this value is fully recognized was shown by the unanimous adoption of a resolution of thanks to the secretary of the Bureau of Commerce and Labor and to Supervising Inspector General Uhler. General Uhler, in his remarks, very clearly explained the difficulties under which the board acts in its task of interpreting and applying the steamboat inspection law, many sections of which have, by reason of the vast increase in the steam tonnage of the country, and the improvements made in engines, boilers and the materials of which they are constructed, become obsolete and in many cases even worse than that, tending to intensify the very evils which they were originally intended to correct. A single instance of several given in his remarks shows this very clearly. The steamboat law was, in the beginning, mainly based on conditions existing on our western rivers. In order to have the pump for fire service, for instance, ready at hand for the engineer, the law prescribes that no pump for fire service shall be placed below the lower deck of a vessel. On a Mississippi river steamboat, this means the same deck on which the engines are located, so that the engineer need only turn around or make a very few steps to at once reach the fire pump on which depends the safety of the vessel in the event of a conflagration; but the lower deck on a steamship, as understood in the lake and salt water service, is several galleries or platforms above the post of the engineer; yet, by the distinct provision of the law, the fire pump has to be placed in this position that would be known as the lower deck of the vessel, and the object sought by law, that is to have the fire pump ready at hand for instant use by the engineer, is thus rendered nugatory. Yet, it took several years of active discussion by steamship owners with the full co-operation of the Board of Supervising Inspectors, to have this language modified so that the safety sought might be insured. Other instances were also mentioned. General Uhler very vehemently expressed his conviction that the main duty of the Board of Supervising Inspectors was to render our steamboat and steamship service the best and safest in the world, expressing, in fact, the idea, on which the A. B. M. A. was founded, as shown by the preliminary discussion of that association at its first meeting in Pittsburg in 1889.

What was of the greatest interest to the assembled boiler manufacturers at the convention was the fact that General Uhler's remarks indicated a definite policy and a most commendable one on the part of the administration. In giving expression to this he said that it was not only the understanding but the desire of the secretary of the Department of Commerce and Labor that all interests should be and could be represented before him or the proper bureau officer at any time,

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and that it is the purpose as well as the policy of the department to advance the progress of all industrial enterprises and institutions rather than to retard by any technical requirements or regulations the convenience or business interests of the community. General Uhler set forth a clear understanding of what is required and what might be expected. He explained that Sec. 433 of the present law works a disadvantage to manufacturers generally in that they are prohibited from constructing a boiler that would be for all intents and purposes a better boiler than might be constructed under the present law, and he suggested that the efforts of the association should be rather directed toward the repeal of this law than to discussing its obvious disadvantages in practice. The speaker further enlarged upon the possibilities of material—steel particularly—and urged that good steel can be manufactured under present specifications, a statement which he fortified by presenting samples of materials that were remarkable both for their tensile strength and their ductility. The speaker believed that our material was superior and our design and construction equal, if not superior, to any of foreign origin or production, and that the present steamboat inspection law, although in some particulars imperfect, is equal to the inspection laws of any nation upon the face of the earth.

Past President H. J. Hartley, of the William Cramp Ship & Engine Building Co., described some boilers recently constructed by that company under his supervision, notable in character in regard to its strength and thickness of materials entering into their construction, and also being the heaviest and highest pressure Scotch marine boilers ever constructed in this country. They are designed to carry a constant working pressure of 234 lbs. steam per sq. in., for the purpose of supplying steam for two 7,500 H. P. triple expansion engines for propelling two 7,000 ton ships now in course of construction by the William Cramp & Sons Co. for the Southern Pacific Steamship Co., to be used in its passenger and freight traffic between New York and New Orleans. Each of these ships contains four single ended and three double ended boilers; the single ended type being 15 ft. 4 in. in diameter by 11 ft. long, each containing four Fox corrugated furnaces 3 ft. 5½ in. in diameter by 8 ft. 8 in. long, 11-16 in. thick, each having a separate combustion chamber. The double ended type is of the same diameter, but 21 ft. 4 in. long, each containing eight furnaces of same size and type, with separate combustion chambers also. The aggregate grate surface contained in the boilers for each ship being 770 sq ft., and the heating surface 26,464 sq. ft., making the ratio of heating surface 34 1-3 sq. ft to 1 of grate surface.

The shells of both the single and double ended boilers are composed of plate steel, 1 11-16 in. thick, double butt strapped and riveted with 1½ in. diameter rivets throughout, each rivet weighing from 2¾ to 4¼ lbs. The sizes of the plates in each length of boiler vary from 5 ft. 9 in. by 24 ft. 7 in. to 7 ft. 8 in. by 24 ft. 1 in., and in weight per plate from 9,817 lbs. to 13,000 lbs., respectively. The fire tubes of the boilers consist of two kinds, viz.: Stay tubes, 2¾ in. in diameter, and ⅜ in. thick, with ends enlarged and threaded for screwing into tapped holes through both front and rear tube plates, and the ordinary tubes, of the same diameter, and No. 8 B. W. G. of an inch thick, which are simply expanded into the tube plates, and their ends beaded over in the usual manner. The air for fuel combustion in the boilers is supplied by natural draft system produced through a double sill oval stack 12 ft. 6 in. by 15 ft. 6 in. diameters, 96 ft. in height above grate bars. The weight of each single ended boiler, without fittings, is 65¼ tons, and that of each double ended boiler 119½ tons, making the total weight of boilers, exclusive of fittings, for each ship, equal to 620½ tons, and including all fittings, such as cast iron bridge walls, grate bars, etc., exclusive of all smoke boxes and up takes, equal to 684 tons for each ship.

The boilers were constructed under the Lloyds rules, requiring a hydrostatic test equal in pressure to double that of the working steam pressure, or equal to 468 pounds per square inch. This, however, was not strictly adhered to, on account of the vessels not being immediately registered under Lloyds rules, and the United States government rules not requiring such a high percentage of hydrostatic test pressure by 50 per cent, a compromise equal to 361 lbs. was substituted, under which test the boilers proved to be unusually and remarkably tight. This showing is noteworthy when it is considered that a few years ago it was thought next to impossible to construct steam boilers of such diameters and thickness of material as described to carry such a working pressure as 234 lbs. The demand for such high steam pressure for boilers has been brought about by the substitution of the modern compound and quadruple expansion engines for the old low pressure type, as formerly and more especially used in the marine service, which usually required from 20 to 35 lbs. steam pressure.

The success and practicability of the high duty engine has been made possible by the ability to procure and work into shape for steam generators a grade of boiler steel capable of withstanding, with safety, such high pressures as are now required for the modern engines so generally in use.

Mr. Hartley concluded his paper as follows:

The bringing about of the possibility of having this high grade of boiler plate steel manufactured had its inception in this city of Pittsburg, 18 years ago, by the formation of an association which had for one of its objects the consummation of a uniform specification, by which a higher grade of steel boiler plate should be made, even regardless of the cost, if necessary, to produce an article which should be superior to that which was in use at that period. The association alluded to in this connection, aided by the co-operation of the steel manufacturers, I am happy to be able to say, has been eminently successful in its mission, and today it is known throughout the country as "The American Boiler Manufacturers' Association of the United States and Canada."

But notwithstanding what has been accomplished in this respect, still greater skilled exertion, with its attending difficulties, is destined for the boiler manufacturer to grapple with in regard to constructing boilers capable of sustaining higher steam pressures than have ever yet been required for commercial motive power. This question is now uppermost in the minds of advanced engineers, with the view of economy in obtaining a higher efficiency from the steam engines within the least possible space, * * * this being especially so when applied to ships, in order to save cargo capacity, as well also as a minimum consumption of fuel, both of which means materially increased earnings for the operators.

In this connection I would state that I was recently verbally informed by a noted superintending engineer of one of the steamship lines plying between New York and the South Atlantic ports that the future new ships to be built for his company's line would be equipped with engines requiring working pressure of steam approaching 300 lbs. per square inch, even if the boilers had to be reduced in diameter to safely carry that pressure. However, it belongs to the future to prove if this prediction will be fulfilled.

Beyond all doubt, however, it is a well known fact, that during the last twenty years there has been a wonderful advance in the direction of higher steam pressures as applied to every branch of motive power, therefore, it is difficult to conjecture, in view of these rapid strides, to what increase the limit of higher pressures will reach.

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General Uhler, who was an attentive listener to the foregoing paper, expressed his pleasure and interest, knowing from his long acquaintance with Mr. Hartley that any contribution from him would be entertaining. While he had great confidence in the ability and capacity of Mr. Hartley, he had not expected in attending the convention to hear a paper from him recounting such enormous pressures. He understood that the ships in question were to use superheated steam. This would mean the practical elimination of composition material valves and fittings, which disintegrate at temperatures ranging at about 400. It means that composition fittings on those ships have been eliminated. The speaker had no doubt that the time is not far distant when steel is going to supersede everything in the nature of conductive compositions for steam, which, with such high pressures, will naturally have to be superheated. The day of the old copper pipe is fast waning, and its prestige is now practically gone. Composition valves, formerly thought to be the only things in the world to withstand the stress of high pressure, more particularly superheated steam, have given away practically to steam fittings, steel bodies, valves and all that. It is easy to prophesy that within a very few years we would see the softer metals discarded entirely and absolutely and their place taken by the more ductile conditions of steel, as we hoped to meet them. The speaker inquired of Mr. Hartley whether in the expanding and beating of the tubes in this construction he had made any longer flange or left any longer piece for the bead, or if he just rolled the ordinary bead on the tube. Mr. Hartley replied that in this case they left a little more on the end. Owing to the use of pneumatic hammers, better sections are obtained in flanging ore without cracking than formerly, when the old keeling out style was in vogue with a hand hammer. The screw tubes are merely expanded, having been screwed in without turning over, because they are 1⅜ and it is impossible to turn that metal over. Mr. Bentley inquired if that was 60,000 steel, and the speaker replied that it was 55,000 to 64,000. Gen. Uhler remarked that it was about 61,720 as an average, and that he remembered the material very well.

Mr. Hartley stated that, owing to the thickness of this plate, in going through the roll the scale would fly off three or four feet and would come out just as clear as if it had been pickled, showing what movement there must have been between the outside and inside in going through the roll. The main feature of these boilers is their immense weight and thickness of material, coupled with the high pressures.

Gen. Uhler recounted some interesting reminiscences going to show the immense progress made in the capacity, tonnage and equipment of sea-going vessels within the past quarter of a century, all of which he thought goes to emphasize the necessity for the highest grade of excellence in material, which has made this progress possible, and which will enable man to go forward and always upward in his efforts to utilize the powers of nature.

The following officers were elected to serve during the ensuing year: President, M. F. Cole, Newnan, Ga.; secretary, J. D. Farasey, Cleveland, Ohio; treasurer, Joseph F. Wangler, St. Louis, Mo.; first vice president, John J. Main, Toronto, Canada; second vice president, J. Don Smith, Charleston, S. C.; third vice president, William H. Fletcher, Hoboken, N. J.; fourth vice president, H. D. MacKinnon, Bay City, Mich.; fifth vice president, H. Goldner, Philadelphia, Pa.

The 1907 convention will be held in Atlanta.

SUMMARY OF NAVAL CONSTRUCTION.

Following is the summary of naval construction as prepared by the bureau of construction and repair. It shows commendable progress on all naval vessels.

Name of Vessel.	Building at	1906: Per cent of Completion. Aug. 1.	Sept. 1.
BATTLESHIPS.			
Nebraska	Moran Bros. Co.	96.	96.38
Georgia	Bath Iron Works	98.43	99.0
Connecticut	Navy Yard, New York	97.00	99.08
Vermont	Fore River S. B. Co.	90.5	92.7
Kansas	New York S. B. Co.	85.8	87.
Minnesota	Newport News S. B. Co.	93.68	95.
Mississippi	Wm. Cramp & Sons	60.83	62.18
Idaho	Wm. Cramp & Sons	59.	60.29
New Hampshire	New York S. B. Co.	50.3	51.8
South Carolina	Wm. Cramp & Sons	0.	0.
Michigan	New York S. B. Co.	0.	0.
ARMORED CRUISERS.			
California	Union Iron Works	94.6	95.
South Dakota	Union Iron Works	92.4	93.
Tennessee	Wm. Cramp & Sons	100.	
Washington	New York S. B. Co.	100.	
North Carolina	Newport News S. B. Co.	53.87	57.18
Montana	Newport News S. B. Co.	47.66	51.03
PROTECTED CRUISERS.			
St. Louis	Neafie & Levy	99.22	100.
Milwaukee	Union Iron Works	97.9	98.5
TRAINING SHIPS.			
Cumberland	Navy Yard, Boston,	95.	98.29
Intrepid	Navy Yard, Mare Island	97.5	98.
SCOUT CRUISERS.			
Chester	Bath Iron Works	40.80	44.97
Birmingham	Fore River S. B. Co.	41.80	44.9
Salem	Fore River S. B. Co.	42.6	45.
SUBMARINE TORPEDO BOATS.			
Submarine T. B. No. 9	Fore River S. B. Co.	81.7	84.9
Submarine T. B. No. 10	Fore River S. B. Co.	69.3	73.
Submarine T. B. No. 11	Fore River S. B. Co.	81.3	85.9
Submarine T. B. No. 12	Fore River S. B. Co.	65.1	69.9

The committee on rivers and harbors of the house of representatives is now making a tour of the rivers of Alabama.

BIDS FOR DREDGING.

Abstract of proposals for removing earth and boulders from Section 3, channel along Bois Blanc Island range, Detroit river, opened Sept. 11, 1906, by Col. C. E. L. B. Davis, government engineer, Detroit.

Name and Address of Bidder	Per cubic yd.	Total.
Dunbar & Sullivan Dredging Co., Buffalo, N. Y.	$0.19⅞	$ 53,861.25
Great Lakes Construction Co., Buffalo, N. Y.	0.22½	60,975.00
Detroit Dredging Co., Detroit, Mich.	0.23	62,330.00
Great Lakes Dredge & Dock Co., Chicago, Ill.	0.37	100,207.00
G. H. Breymann & Bro., Toledo, Ohio	0.57	154,470.00
Buffalo Dredging Co., Buffalo, N. Y.	0.60	162,600.00

The twin screw turbine steamer Creole was launched recently from the yard of the Fore River Ship Building Co., Quincy, Mass. She is building for the New York-New Orleans service of the Southern Pacific Co. The vessel has a straight stem and a semi-elliptical stern with a large smoke-stack and two short pole masts. A large superstructure has been constructed amidships on top the hurricane deck, and the deck-house is superimposed on it. Her principal dimensions are: Length over all, 440 ft.; length between perpendiculars, 415 ft.; breadth, molded, 53 ft.; depth, molded, to upper deck, 37 ft. The Creole has turbine engines.

The battleship Georgia has been placed in commission.

The navy department is looking around for a coal barge of about 2,500 tons capacity to be moored at some convenient place near Newport News.

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SCIENTIFIC LAKE NAVIGATION

By Clarence E. Long

Encircling the earth is the line of no dip on every part of which the needle remains horizontal. Much labor has been bestowed upon the position of this line, which is called the magnetic equator. It cuts the terrestrial equator to the south of the Bight of Benin in Long. 5° 40′ E. The curve then ascends rapidly and reaches its greatest latitude in the interior of Africa, in about Long. 40° E. It thence descends very slowly towards the equator, in its progress eastward, cuts the eastern coast of Africa, traverses the Indian ocean in a direction nearly parallel to the terrestrial equator, crosses the peninsula of India a little to the north of Cape Conorin, crosses the peninsula of Siam, touches the island of Borneo at the northernmost point, and finally reaches the equator in the middle of the Pacific ocean, in about Long. 175° W. The eastern and western nodes of the magnetic equator are therefore very nearly antipodal. The curve then descends to the south of the equator, to which it is nearly parallel through 40° of longitude, viz., from 110° to 150° W., after which it descends more rapidly and traversing the South American continent, reaches its highest southern latitude, close to the eastern shore, in about longitude 40° W. From this point it ascends rapidly until it cuts the equator in the point from which it sets out.

Like the isogonic lines, the lines of equal dip, are winding curves running in an east and west direction. To look at an isoclinical chart one would get a wrong impression of the significance of these lines. Like the isogonic lines the earth should be imagined to be covered completely with dipping needles without influence upon one another, all over its surface. These lines would then represent a series of straight lines in the plane of the magnetic meridian.

These isoclinic lines have such inscriptions as 50°, 60°, 80°, etc., printed underneath them, and this means that if we follow the line of dipping needles which have all, say 70° of inclination, or dip, we pursue an isoclinic line. If in the north magnetic hemisphere the north end of the needle would point downwards and make an angle with the horizon corresponding to the inscription printed under it. In the south magnetic hemisphere it would be the south end of the needle. We have thus far seen that the earth's magnetism, which operates in two coordinate planes, is measured in direction and magnitude, and now we come to its intensity of force. This is estimated according to methods of vibration of the needle, both in the horizontal and vertical planes, one is called the horizontal intensity of force, and the other the vertical intensity of force. We have seen that the vertical force is greatest at the poles and zero on the magnetic equator, which separates the two polarities from each other. The horizontal force is zero at the poles and greatest near the magnetic equator. Also that both forces increase and decrease at different places on the earth's surface.

If a magnetic needle, either horizontal or vertical, be moved from its position of equilibrium it will revert to it after a series of oscillations which follow laws similar to the pendulum. If the needle be removed to another position on the earth and caused to oscillate during the same length of time as the first, a different number of oscillations will be observed. And the intensity of the earth's magnetism at the two places will be respectively proportional to the squares of the number of oscillations.

If at M the number of oscillations in a minute had been 25 equals n, and at another place, M′ 24 equals n′, we should have

$$\frac{\text{Intensity of the Earth's Magnetism at M}}{\text{Intensity of the Earth's Magnetism at M}'} = \frac{N^2}{N'^2} = \frac{625}{575} = 1.085$$

That is, if the intensity of the needle at the second place be taken as unity that of the first is 1.085. If the magnetic condition of the needle had not changed in the interval between the two observations this method would give the relation between the intensities at the two places.

The needle in each case must be deflected the same amount in timing the number of vibrations in a minute. From the foregoing we can see that the horizontal intensity is greatest near the magnetic equator and decreases towards the poles, that is, the vibrations in the minute would show the most near the equator and the less the nearer the poles are approached.

In the vertical intensity of force the axis of the dipping needle must be placed in the direction of north and south, and the needle itself made to vibrate towards the east and west points by compass. In this position the dipping needle is influenced by the earth's vertical force only.

FREAKS OF MAGNETISM.

We now come to some remarkable freaks of magnetism, which are due to unknown laws, and have been deduced from actual observations of discovery. There are places or points on the earth's surface where the horizontal and vertical forces are greatest, and other places where these forces are least. These are called maximum and minimum intensities.

Now, from what has already been said we would naturally suppose that at either of the magnetic poles the dipping needle would show the greatest number of vibrations in a given length of time, but not so, the place of maximum intensity in the northern hemisphere, according to the charts showing the vertical force, forms a bight, or a portion of a loop, about as follows: Commencing in the Polar sea in latitude 70° N., longitude 80° W. its course is traced in a SSE direction around Hudson bay, crossing the parallel of 60° at about longitude 70° W.; it there follows around the south end of the great lakes, in about latitude 41° N., crossing the meridians 80°, 90° and 100° W.; it then follows a northwesterly direction crossing the meridian of 120° W., in about latitude 55° N. and the meridian of 133° W. in latitude 60° N., and back to the parallel of 70° N. in longitude 155° W.

The line having the greatest vertical force is situated in the southern hemisphere in the Indian ocean and the South Pacific in latitude 65° S.

EQUAL LINES OF VERTICAL FORCE.

Lines of equal vertical force are lines connecting places in which the vertical force is of the same intensity.

Again, we would naturally suppose that the least vertical intensity of force would be on the "line of no dip," or magnetic equator, that is, the least number of vibrations of a vertical force instrument would be shown on the magnetic equator, but no, it is on the dynamic equator that this occurs. The dynamic equator is an irregular curve encircling the earth and drawn through that point in each meridian on which the magnetic intensity is least. It is this curve that is the true line of demarcation between the northern and southern magnetic hemispheres, separating the opposite phenomena of the diurnal changes, and dividing the forces

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which attract the north end of the needle from those which attract the south end. The dynamic equator has reference to the intensity of the magnetic force. The force is of unequal intensity in the several parts. This equator separates the forces which attract the north end of a magnetic needle from those which attract the south end, and is the true line of separation between the two magnetic hemispheres.

The greatest horizontal intensity of force is near the geographical equator as should be the case even if the total force were everywhere constant, since as the dip decreases the horizontal component of the force must increase.

Lines that pass through all the points where the horizontal intensity of force is the same are called lines of equal horizontal force, or lines of equal magnetic intensity or isodynamic lines. In each hemisphere there are areas where the horizontal intensity of force is greatest, that is, where the horizontal force instrument, or any horizontal magnetic needle, will show the greatest number of vibrations in a given time. They first form a series of ovals round each of the maximum points. The line representing the greatest horizontal intensity is located in the eastern hemisphere in the locality of the East Indies. It is turnip-shaped and is situated between the meridians of 85° E. and 140° E. and between the parallels of 16° N. and 10° S., being nearly as much on one side of the true equator as the other.

The next greatest area is in the western hemisphere in the vicinity of Central America, between parallels of 2° N. and 12° N. and between the meridians of 96° W. and 114° W.

The least horizontal force is in Baffins land, British North America. This line of east intensity starts in at latitude 70° N. and longitude 70° W., and runs south and west and crosses the parallel of 60° N. at about the meridian of 73° W.; it then runs to the west and north across Hudson bay, its least latitude being about 58° N.; it then crosses the meridian of 100° W. in the parallel of 60° N.; from there it runs northwesterly and crosses the parallel of 70° N. at about the meridian of 124° W.

The line of least intensity of horizontal force is for the most part located in the southern hemisphere, south of Australia, between the parallels of 60° S. and 65° S.

The line of weakest force (vertical) on the globe has been traced with great care. It is an irregular line lying for the most part to the south of the geographical equator (the magnetic equator lies mostly to the north of the true equator). It reaches its maximum of northern latitude in the Pacific ocean in about 165° E. longitude, where it attains the latitude of 14° N. Its southern limit lies in the Atlantic ocean, in about 20° W. longitude. It is not a line of equal intensity; on the contrary, it intersects the weaker isodynamic lines, which appear to form loops in two points, one in the Atlantic and the other in the Pacific ocean.

The line then of least intensity of vertical force does not coincide with the magnetic equator, and that neither of these lines is an isodynamic line. At one time the magnetic equator was supposed to be the locus of least intensity, and also an isodynamic line.

INTENSITY.

The foci of magnetic intensity, with their systems of curves, are moving along the two hemispheres in different directions, those in the northern hemisphere going from west to east, those in the southern from east to west; and as the foci move with different velocities, the forms, as well as the position of the curves, are continually changing.

MAGNETIC STORMS.

But over and above all regular changes there is a large amount of irregular fluctuation, which occasionally becomes so great as to constitute what is called a magnetic storm. Magnetic storms are not connected with thunder storms, or any other known disturbance of the atmosphere; but they are invariably connected with exhibitions of aurora borealis, and with spontaneous galvanic currents in the ordinary telegraph wires; and this connection is found to be so certain, that upon remarking the display of one of the three classes of phenomena we can at once assert that the other two are observable.

The phenomenon of earth currents appear to be connected with that of the changes in the earth's magnetism, and can be observed whenever there is a display of aurora, and during a magnetic storm; but it is not yet determined whether these currents are due to the variation in the magnetism of the earth, or whether these variations are due to the currents. It is known that the evaporation always going on in the tropics causes the ascending currents of heated air to be electrified positively to the earth. These air-currents travel northward and southward toward the polar regions where they descend. These streams of electrified air will act like true electric currents, and as the earth rotates within them it will be acted upon magnetically. Whether this will account for the gradual growth of the earth's magnetism is an open question. The action of the sun and moon in raising tides in the atmosphere might also account for the variations mentioned. It is important to note that in all magnetic storms the intensity of the perturbations is greatest in the regions nearest the poles; also that the magnetic poles coincide very nearly with the regions of greatest cold; that the regions where the aurorae are seen in greatest abundance is a region lying nearly symmetrically round the magnetic pole.

TERRESTRIAL MAGNETISM.

The cause of terristrial magnetism is undetermined, but it is not improbable that it is induced by electricity generated in the luminiferous ether by the rotation of the earth. Magnetic storms, or unusual movements of the magnetic poles and meridians, producing sudden vibrations of the compass needle, and sometimes interfering with the working of the telegraph lines, occur occasionally, and are most frequent at intervals of eleven years—corresponding to times of great disturbance in the sun.

MAGNETIC MERIDIANS VS. ISOGONIC LINES.

Note.—The terms magnetic meridian and isogonic line have been used here as being synonymous. A magnetic meridian is a line drawn, or imagined to be drawn, in the direction shown by a magnetic needle suspended in the horizontal plane, and free to act in obedience to the earth's magnetic force, and none other; that is, a line drawn to coincide with the needle at rest in this position shows the direction of the magnetic meridian; or the ends of the freely suspended needle mark or point out the magnetic north and south line at the position of the observer on the earth's surface; or it may be defined as the natural direction pointed out by the compass needle.

Isogonic lines are lines connecting those places on the earth's surface at which the variation or declination of the compass, is the same. This means that if the variation is 5° easterly at one place or point on the earth's surface, and 5° easterly at another and so on around the world, and each point or place be marked with a dot, and a flowing line drawn so as to connect all these points with one another, no matter how irregular they may be, represents an isogonic line of 5° easterly variation, or the magnetic meridian at any place on this isogonic line forms an angle of 5° with the true or geographical meridian.

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From this it can be plainly seen that an isogonic line must of necessity be a magnetic meridian, and vice versa, and that we cannot have one without the other.

Looking at a chart showing the isogonic, or lines of equal variation, as well as the agonics, or lines of no variation, one would naturally suppose that the direction of these lines as they curve in and out snake-fashion, in depicting their actual course, be such that the curve or line representing, say 5° of variation (which is a magnetic meridian) would cut the true meridian at this angle all along the line. It really does, but to look at it on the chart this would not appear to be so because they all trend in about the same general direction, and are about parallel with one another, whether it be a line of no variation or one with 10° of variation. In order to get the true or right idea of this, it must be reasoned on the principle of the arc of a great cicle, and that is, that any small arc of a great circle on the earth's surface is practically a straight line, hence, these isogonic and agonic lines are a series of straight lines for a given space on the earth, when it comes to a practical application of their usage. The reason these isogonic lines appear to be sinuous, or winding and retain about the same angle with the true meridian, no matter what amount the variation be, is due to the fact that they are drawn on small-scaled charts encompassing a large area of section of the earth. If a small section of land or water, a harbor or bay, for instance, be drawn to a large scale and the isogonic line or lines marked according to its direction and magnitude over its surface, it will be found to coincide or run parallel with the magnetic meridian, and is, for all practical purposes a straight line. The section charted would have to be, of course, limited in size. The variation is practically the same in any place in the same locality within a space, say of 10 or 15 square miles, and in any direction from the place that it is given for. For an example, the variation at Milwaukee is 3½° easterly. If you were say eight or ten miles in any direction from that port, and you wished to use the variation for your position for any purpose, you would use the variation given at Milwaukee.

Another way of getting at this seemingly puzzling subject is to imagine the surface of the earth covered completely with magnetic needles without influence upon one another, we would then find our straight isogonic lines, or series of magnetic meridians. Drawing a sinuous curve through all the needles having the same amount of variation, or making the same angle with the true meridian, we will have our isogonic lines of various magnitudes. We would also find certain of these magnetic needles having no variation, that is, not deflected from the true meridian, but coinciding therewith; the line joining all such needles is called the line of no variation, or agonic line. Hence, it must be plainly seen that there are an indefinite number of magnetic meridians scattered over the surface of the earth, and such is the truth.

The lines of equal variation, although of great use to the navigator, are ill adapted to carry a distinct view of the phenomena in themselves, or to exhibit their physical relations. The most natural, as well as the most instructive modes of grouping graphically the observed results, seems to be that adopted by Duperrey in the charts published in 1836. The curves of Duperrey indicate—not the deviation of the needle from the true north at each place—but its actual direction. The magnetic meridians in this case are curves traced on the globe, to which the direction of the freely suspended horizontal needle is everywhere a tangent. At each point therefore, the direction of the curve is that of the magnetic meridian of the place. These meridians converge toward two points, one in the northern and the other in the southern hemisphere. They do not, however, all meet in the same point; but the successive intersections of each pair of contiguous meridians form a closed curve, the central points of which may be denominated magnetic poles. The north magnetic pole, so defined, is nearly in latitude 70° N., longitude 98° W.; that of the south magnetic pole is to the south of Australia in latitude 75° S., longitude 138° E.

The magnetic meridian, like the lines of force in the iron filings, indicates the direction in which a freely swinging magnet will settle to rest at localities in that meridian.

RECAPITULATION.

Magnets are either permanent or temporary. Permanent magnets were originally natural pieces of magnetic iron ore. They now usually consist of bars of steel, which are magnetized either by rubbing them with another magnet, or by a coil of wire wound round them and then sending an electric current through the wire. The harder the steel the more difficult it is to magnetize, but the more completely does it retain its magnetism. Permanent magnets are either straight or are bent into the form of a horseshoe. In the latter form the two poles are close together, and are thus able to act simultaneously on the same magnetic substance.

A magnet consisting of only one bar of steel is called a simple magnet; but since thin long magnets are more powerful in proportion to the weight, compound magnets are constructed by fastening together several thin steel bars previously magnetized. Some of these compound magnets are very powerful.

The property of magnetism was first discovered in the natural oxide of iron, called loadstone. The earth itself having magnetic properties, such a magnet pointed nearly north and south, when freely suspended, and also attracted small pieces of iron. It was subsequently discovered that pieces of steel rubbed with natural magnets also became magnets; and these artificial magnets, besides being more convenient, may be made much more powerful, so that natural magnets are now only sought as curiosities. The attraction of a magnet for iron filings is most intense at a short distance from the ends, and decreases towards the middle; at the center there is no attraction, and this center is termed the equator of the magnet. The points at which the magnetism is most intense are called the poles. It is evident that the magnetism at the two poles is different and that pole which points to the north is termed the north-seeking pole, whilst that which points to the south is called the south-seeking pole. If two magnets are taken, and the north-seeking pole of one is brought near the north-seeking pole of the other, they repel each other; but if the north-seeking end of one is brought near the south-seeking end of the other, then they attract each other. Therefore, like or similar poles repel; unlike or dissimilar poles attract each other.

QUESTIONS FOR OILERS AND WATERTENDERS.—NO. 8.

71. Of what does coal consist?

72. Can you give the relative proportions that enter into coal?

73. What must be mixed with coal before it will burn?

74. What ingredients of the air mix with the ingredients of coal?

75. Approximately how much air must mix with coal?

76. In how many ways is heat transmitted? What are they?

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77. What is latent heat?

78. Taking a quantity of ice, explain what is meant by latent heat.

79. If a boiler stay is worn away until the smallest part is 1⅛-inch diameter and the stays are 16 inches apart, the government allowance is 5,000 lbs. pressure per sq. in., section of stay, what direct weight will be required on a 4-in. safety valve?

80. A blow-off cock on the bottom of the boiler is 14 ft. below sea level and 9 ft. below the water level in the boiler, what pressure per sq. in. would be required to enable the water to be changed?

QUESTIONS FOR MASTERS AND MATES.—NO. 11.

160. Name the principal parts of the mariner's compass.

161. Why is the bowl of the mariner's compass filled with liquid?

162. What kind of a compass is a Ritchie compass?

163. What kind of liquid does its bowl contain?

164. Can you see the magnets of a Ritchie compass?

165. How would you expel an air bubble in a Ritchie compass?

166. Where is the expansion chamber of a Ritchie compass?

167. What is the object of the expansion chamber?

168. What kind of packing is used to make the glass top of a Ritchie compass perfectly air-tight?

169. What is spirits of wine composed of?

170. Does extreme heat affect a compass? What is the effect?

171. What effect does extreme cold have on a liquid compass?

172. What are the essentials of a good compass?

173. How should a compass behave in a sea-way?

174. Can you see the magnets of a Baker compass through the glass top?

QUESTIONS FOR WHEELSMEN AND WATCHMEN.—NO. 12.

Give all shoals and principal land marks passed on either hand.

In taking true course to make good the corresponding correct magnetic course you should take the mean of variations at the ends of each course.

123. You are steering up through Grosse Point Cut with Isle Aux Peches ranges over stern, compass reading NE; when abreast of lightship, weather becomes smoky or hazy, how much would you shift your course and which way to make good a course to entrance of Lake St. Clair ship canal?

124. Give correct magnetic course and distance from Lake Huron lightship to a point four miles E of Sand Beach main light.

125. Give correct magnetic course and distance from 4 miles E of Sand Beach main light to entrance buoy Saginaw river.

126. Give correct magnetic course and distance from Saginaw river entrance buoy to a point two miles E of Thunder Bay island light.

127. Give correct magnetic course and distance from Sand Beach main light to a point one mile SW Tawas Pt. light.

128. Give true course and corresponding correct magnetic course and distance from Sand Beach main light to Alpena.

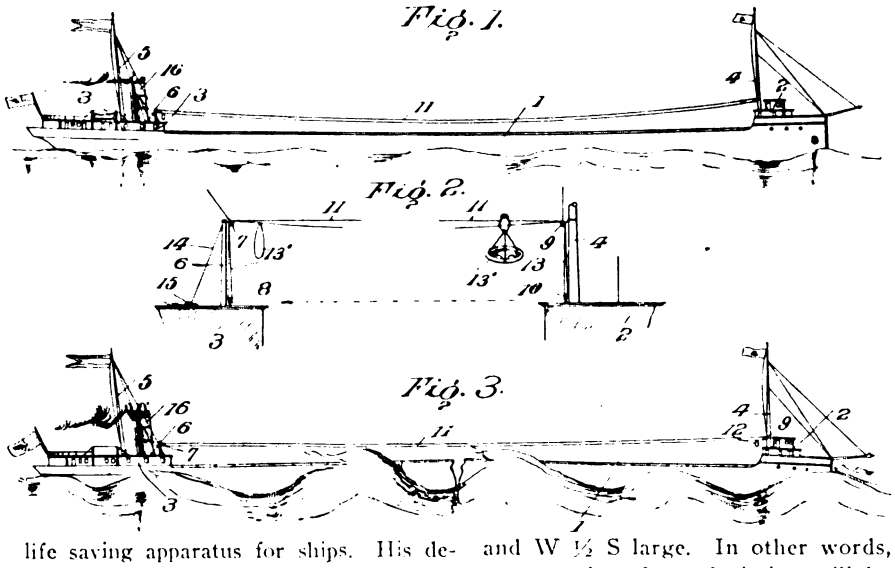
129. Give correct magnetic course and distance from Sand Beach main light to a point four miles E of Thunder Bay island light.

130. Give correct magnetic course and distance from a point four miles E of Thunder Bay island light to a point three miles NE by E of Presque Isle light.

131. Give correct magnetic course and distance from a point four miles E of Thunder Bay island light to Frying Pan and Pipe island ranges.

LIFE LINE ABOARD SHIP.

Mr. George S. Stevens, of Duluth, was granted a patent on Aug. 21 last on a life saving apparatus for ships. His device has special reference to the ordinary type of lake freighter. It was clearly brought out in the great storms of last year that some means of communication between forward and after parts of the vessel should be available at all times. Lives were lost on the Mataafa because the men aft were unable, owing to the heavy seas constantly breaking over the vessel amidships, to get forward. As shown in the accompanying drawings, Mr. Stevens' device consists of a life line rigged on a double track rove through blocks on spars fore and aft, fitted with a breeches buoy and traveling at a sufficient height to clear the highest seas.



HEADING INTO MILWAUKEE HARBOR.

Editor Question Department:—I would like Mr. Long to explain the following. In Notice to Mariners No. 34, Hydrographic Office, Aug. 25, Milwaukee rear light is given as bearing west true (W. ¼ S. Mag.) from front light. The lighthouse book says the north pier runs E, ¼ N. (W ¼ S), and the bearings in it are given as true. Now, both lighthouses are in line of north pier. According to one I should head in piers W ¼ S correct Mag., and according to the other, I should head W ½ S cor. Mag. I would like to know which is right. Quarter of a point is too much to be wrong in a course.

Yours truly,
INQUIRER.

Answer:—Milwaukee piers extend into lake in the same true direction that they always did, which is E ¼ N (W ¼ S). The lights on north pier are in range with that pier, and are parallel with the channel for entering. The variation at Milwaukee is a trifle better than 3 degrees easterly, therefore the correct magnetic bearing of the pier range is E ½ large and W ½ S large. In other words, a compass free from deviation will head in and out of the piers E ½ N (large), and W ½ S (large). The true bearing given in the lighthouse book is correct. Notices to mariners cannot always be relied upon.

Whenever in doubt about anything like the above, an azimuth or two will tell you all about it. Get boat on range; clamp sight bars of pelorus to the true bearing of the sun on pelorus dial according to date, time, etc., and point them to the sun's center. The reading of pelorus compass at ship's head will give you the true bearing or direction in which headed.
LONG.

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LAUNCHING THE MAURETANIA.

The Cunard express steamer Mauretania, which was launched Sept. 20 at Wallsend-on-Tyne, has been in progress since the autumn of 1904, and it is expected that she will be completed by the autumn of next year. Her builders, Messrs. Swan, Hunter & Wigham Richardson, are already represented in the Cunard fleet with the Ultonia, Ivernia and Carpathia, which excellent vessels, however, are quite eclipsed by the work upon which this well known firm are at present engaged. The yard of Messrs. Swan, Hunter & Wigham Richardson lies on the left bank of the Tyne, at Wallsend, between Newcastle and Tynemouth.

The first portion of the work of construction was the laying of the keel plate, which is 5 ft. wide and 3¾ inches thick, and is flush outside with the bottom of the ship. Associated with this flat keel is a vertical keel, 5 ft. high and 1 in. thick, and to this vertebra are attached directly or indirectly the frames and beams which make up the skeleton of the leviathan.

The double bottom is divided by a vertical keel 5 ft. high, and transverse frames, into compartments in which water ballast may be carried. The tops of these tanks are carried well round the turn of the bilge, so that should the bilge keels be torn away and the hull pierced the entering water would be confined between the inner and outer bottoms. This is only one precaution in the direction of securing unsinkability. The lower deck is made completely watertight. Below it are the lower orlop and orlop decks, and above are the main, upper, shelter, promenade, upper promenade and boat—nine decks in all. It is necessary, of course, that there should be means of communication between one water-tight compartment and those contiguous, and on the Mauretania these communicating doors at or below the water line are of a special type, and can be closed automatically from the navigating bridge, and that in a few seconds. In all, the Mauretania will have 175 water-tight compartments, so that it may be claimed for her that she is as unsinkable as a ship can be.

The steel plates which cover the ribs or framing of the vessel or are used for decks, bulkheads and casings or in other ways, number 26,000, the largest being about 40 feet in length and weighing from four to five tons.

To secure these plates to each other and the structural frame work of the ship, over 4,000,000 rivets have been used, aggregating in weight about 500 tons. The largest rivets are used in the keel plate and these are 8 in. in length, and weigh two and three-quarter pounds. The main frames and beams placed end to end would extend thirty miles; the rudder, which has two sets of steering gear, one of which is below the water line, weighs 65 tons, and the diameter of the rudder stock is 26 in. The castings for the stem, stern post, shaft bracket and rudder together weigh 280 tons. Her ground gear is, with that made for the Lusitania, the strongest yet made.

The three anchors each weigh ten tons, while the 1,800 ft. of cable is composed of 22-in. links, the iron in which is 3¼ in. in diameter and the weight of each link about one and one-half hundredweights. Every portion of this harness has been vigorously tested, each link and shackle emerging successfully from a test strain of 370 tons.

DIMENSIONS AND SOME COMPARISONS.

The principal measurements of the Mauretania are:

Length	790 ft.
Breadth	88 ft.
Depth (molded)	60 ft.
Gross tonnage	33,200 tons.
Displacement tonnage	45,000 tons.
Load draught	37 ft. 6 in.
Height of funnels	155 ft.
Diameter of funnels	24 ft.
Height of masts	216 ft.

These figures convey but the bare idea of the great size.

A favorite standard of comparison in shipping is the leviathan of Brunel, the Great Eastern, the mammoth steamer, which born before its time, yet solved in her construction many of the most difficult problems with which the modern builders of big ships have to grapple; yet the Mauretania dwarfs even the gigantic Great Eastern, as the following figures show:

	Great Eastern	Mauretania.
Length	692 ft.	790 ft.
Breadth	80 ft.	88 ft.
Displacement	27,000 tons.	45,000 tons.
Paddle, screw, sail.		Quadruple screws.
Speed	14 knots.	25 knots.

The Great Eastern was an experiment, but there is nothing of the experiment about the Mauretania and her sister, the Clyde-built ship Lusitania. The valuable data obtained from the running of the 20,000-ton turbine Cunarder, Carmania, has afforded a valuable object lesson in adapting the turbine system of propulsion to liners of the leviathan class, demonstrating the suitability of this type of propulsion to the largest type of vessel.

Mauretania was the ancient name of the northwestern portion of Africa, that portion whose littoral marked the gateway to the Mediterranean, through which in Roman times passed much of the world's over-sea commerce.

The Mauretania will be propelled by turbine engines of 70,000 indicated horsepower, driving four shafts, each of which is fitted with one three-bladed propeller of manganese bronze. The outermost shafts are each connected with a high-pressure turbine, the inner shafts being rotated by the low-pressure turbine.

The Mauretania complies with the admiralty requirements as an armed cruiser, and will be fitted for an armament of twelve 6-in. guns. These guns represent her offensive powers. With the view of protection, her rudder and one set of steering gear are below the water line, and in the way of the engine and boiler rooms there are side bunkers which, filled with coal or water, will be equivalent to an armor belt round the vulnerable portion of the ship.

The construction of so huge a ship demanded special arrangements for the building and launching of the hull, and the subsequent completion of the vessel. The vessel has been built under an enormous shed. The huge edifice is 150 ft. high, is built of steel lattice work, with a glazed roof. High up in the roof of the structure are electric cranes for manipulating the plates, girders, etc., used in building the ship. This building shed insures protection from the weather for the workmen and so expedites the work of construction. As the ship progressed, electric lifts were built and these convey the workmen to the various decks, the topmost of which, the boat deck, is 120 ft. above the ground.

For lifting the weighty boilers and the turbines into the vessel, a huge floating crane has been built with a lifting power of 140 tons.

The Mauretania will be completed while lying in the Tyne, alongside the yard of Messrs. Swan, Hunter & Wigham Richardson, but the depth of water in the river is not sufficient to allow her to lie right alongside the river bank. It has, therefore, been found necessary to construct two mooring dolphins, to which she will be attached. In addition a large steel buoy has been built, to which she will also be moored. To connect the ship with the shore, and so provide a means of communication for the workmen, two steel gangways have been built, each 120 ft. in length.

One problem which the builders had to face was the exact form of hull which was calculated to offer the minimum of resistance in its passage through the water, a problem the difficulty of which was enhanced by the high speed at which the ship is to be driven. To assist solution Messrs. Swan, Hunter & Wigham Richardson constructed a model to scale with a length of 42 ft. 6 in. The hull of the model was fitted with quadruple screws, driven by electricity, and after many experiments in the Northumberland Dock the best design for the leviathan's hull was arrived at.

And while the hull was gradually

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growing, the 16,000 tons of steel in keel and frames and plating were being welded into a homogeneous graceful whole; preparations were in progress for the transfer of the ship to the adjacent Tyne, and her subsequent conduct to the sea. The river at Wallsend is only 750 ft. wide, or 10 ft. less than the length of the ship. Consequently the Mauretania has been built at a slight angle to the river, so that she takes the water in such a manner that her plunge carries along a diagonal line towards the opposite shore. And along that line dredges have been at work deepening the river bed, and when the Mauretania is ready for sea there will be a channel available which she can negotiate with safety. Thus the building of the ship on the Tyne will confer a benefit on all the shipping using that busy water-way.

As the river is so narrow, great care had to be taken to arrest the way of the ship as soon as she was water-borne. This was done by harnessing to the hull masses of chain cable, each about 100 tons in weight. As the vessel gathered momentum, these several masses opposed their inertia to the moving ship and successfully brought her to rest.

The Mauretania will be fitted with accommodation for 2,300 passengers, of whom 500 will be first class, 500 second and 1,300 third. The crew will number over 800, so that the complement of passengers and crew will be over 3,000. The promenades and living spaces allotted to the passengers are designed on a most generous scale, the space allowed to each passenger being about 50 per cent greater than in any other of the recently constructed liners crossing the Atlantic. In the architectural treatment of the public rooms and cabins, the owners and builders aim at surpassing anything at present in the way of ship and comfort in the first, second and third class accommodation.

Among special features introduced into the new leviathan will be the en suite rooms, 10½ ft. from floor to ceiling, the arrangement of the dining saloon which provides for table d'hote or dining a la carte if desired, a verandah cafe, a nursery for the use of juvenile travelers, electric lifts for conveying passengers from one deck to another, baggage and other lifts, a complete telephone system giving communication between the staterooms and the purser's offices and the surgeries, and also between the different parts of the ship, bridges, engine rooms, crow's nest, and the rooms of the principal officials, whether navigational, engineering, or administrative. In short, nothing that can be devised for the comfort and pleasure of passengers is being neglected.

A special study is made of the lighting and ventilation, there being no fewer than 1,200 windows and sidelights, including 500 patent ventilating lights. Artificial illumination will be furnished by 5,000 electric lights, the transmission of the current to which will necessitate the use of as much cable as would link the head office of the Cunard company at Liverpool with the West End London office.

What a contrast between the accommodation provided on the Mauretania and that provided sixty-odd years ago on the Britannia, the pioneer Cunarder. How does Charles Dickens describe the stateroom which he and his wife used on their trip to the United States in 1842? He says the room was so small that it would hardly hold the baggage, had a hard slab-like seat covered with hair, while the bunks, of which there were two, boasted a very flat quilt covering, a very thin mattress, spread like a surgical plaster on a most inaccessible shelf. Nor did the saloon impress the novelist any more favorably. "We passed," says he, from the deck into a long, narrow apartment, not unlike a gigantic hearse with windows at the side, having at the upper end a melancholy stove at which three or four chilly stewards were warming their hands, while on the other side, extending down its whole dreary length, was a long log table, over each of which a rack, fixed to the low roof and stuck full of drinking glasses and cruet stands, hinted dismally at rolling seas and heavy weather."

Though Dickens' word picture is doubtless overdrawn, passengers must have been cabined, cribbed and confined in their little staterooms, which were veritable boxes compared with the cabins of the Mauretania. Spacious, light and airy, the rooms are well furnished with all the comforts and conveniences to be found in a sleeping apartment of a hotel of the highest class. Dickens complains that in his stateroom the jug of cold water provided for ablutionary purposes was upset through the movement of the ship. On the Mauretania, however, the passenger by turning a tap secures hot and cold water as he would in a lavatory ashore.

The bureau of yards and docks has awarded contract to the Westinghouse Co., Pittsburg, for supplying the electrical equipment at the Norfolk navy yard at $91,995.

The Harlan & Hollingsworth Corporation, Wilmington, Del., is building a wrecking vessel 200 ft. long, 50 ft. beam and 20 ft. deep for the Merritt & Chapman Derrick & Wrecking Co.

PIERS, ST. CLAIR FLATS CANAL.

Abstract of bids for furnishing and placing stone in piers at St. Clair Flats Canal, Mich., received and opened Sept. 17, 1906, (3,000 cubic yards), by Col. C. E. L. B. Davis, Detroit:

Name and address of bidder.	Price per cu. yd.	Total.
1. The M. Rabbitt & Sons Co., Toledo, Ohio....	$2.40	$7,200
2. Wm. S. Piggins & Sons, Detroit, Mich..	12.00	36,000

ITEMS OF GENERAL INTEREST.

The steamer building at the yard of the Toledo Ship Building Co., Toledo, for G. A. Tomlinson of Duluth, will be named Sierra.

The Rust Boiler Co., of Pittsburg, Pa., has secured the order for the boilers for the United States Steel Corporation's new plant at Gary, Ind., the order being for sixteen 400-H. P. Rust water tube boilers.

Capt. Joseph A. Garant, mate for the past season with Capt. Chas. H. Franke on the steamer Henry W. Oliver, has accepted a position as light house keeper on Gallo Island in the tenth district. Capt. Garant was formerly a master in the Bradley fleet.

C. H. Mallory & Co. have awarded the Newport News Ship Building & Dry Dock Co. a contract for a passenger and freight steamer to be 417 ft. long, 54 ft. beam and 37 ft. deep. The steamer has been designed by Cary Smith & Ferris of New York.

William F. Gardner, who has been second mate of the steamer Henry W. Oliver all season, was given a mate's berth when she put in at Ashtabula last trip on account of Capt. Joseph A. Garant, the mate, getting off to go into the light house service. Mr. Gardner is quite a young man, and has only been sailing ten years.

Capt. R. E. Donaldson, master of the steamer Australia, made his last trip down to Lake Erie to Ashtabula. During her lay in port, Orton J. McGaw, the mate, turned to with his crew and dressed his boat in a new coat of red paint above and below the water line. George Aubertine is second mate on the Australia and John Radford and James M. McVicar are chief and second engineers.

It is expected that it will be possible to walk through the Pennsylvania railroad's tunnel under North river from New York to Weehawken early next week. Tuesday, Sept. 18, the bores of the northerly tubes will meet if the engineer's calculations are correct. The report received by Mr. Charles M. Jacobs, the chief engineer and designer, is to the effect that the bores meeting head-on are only an eighth of an inch out of alignment and only three-quarters of an inch out of grade.

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DETROIT RIVER TUNNEL.

The contract for the construction of the Detroit river double-tube tunnel of the Michigan Central has been awarded by the Detroit River Tunnel Co. to Butler Bros.-Hoff Co., of New York city. The contract calls for the completion of the tunnel by June 1, 1909, and the work is already under way. As the tunnel will be built according to a modification of the design suggested by Mr. Wilgus, vice president of the New York Central and head of the advisory board, which design involves a new departure in subaqueous tunneling methods, further details of the final, modified plan are here presented.

The design of Mr. Wilgus is a trench method. In accordance with the plan, before sections of the steel tunnel tubes are floated into place, and immediately after the dredging for the section has been completed, piles are to be driven in the bottom of the dredged channel and cut off at the proper height (or an inch or so below to permit shimming). These piles are to be capped with steel beams to receive the tubes. When the piles are driven, the bottom of the channel to the level of the top of the beams is to be filled with a layer of material of suitable consistency and bearing power, for twelve to eighteen inches in thickness or as much more as may be necessary to fill in holes or depressions left in the bottom of the trench by the dredging operations. This layer will form a blanket between the bottom of the trench and the concrete to be deposited around the steel tubes. For this layer sand and gravel will be used with the addition of cement where necessary.

In the trench and upon the steel beams and bed of gravel and concrete will be sunk tubes of plate steel 3/8 inch thick and weighing an average of 15.3 pounds per square foot. The steel tubes will be built in lengths of 263 feet, or in such lengths as are found most convenient to handle. The plates will be lap-jointed with a double row of 3/4-inch diameter rivets, the outside edges being beveled and caulked so as to be absolutely watertight. The steel tubes are to be reinforced on the outside about every twelve feet by diaphragms which will serve the purpose of a cradle in sinking the tubes to their permanent position. On the inside, midway between the diaphragms, the tubes are to be reinforced with a stiffened angle to which will be attached temporarily, radial rods of one inch diameter, though these rods may be dispensed with if it shall be found that they are not needed. The ends of the tubes are to be reinforced with similar radial rods to prevent deformation during handling. The steel in the tubes is to be of the grade of "railway bridge steel," with an ultimate tensile strength of 55,000 to 65,000 pounds per square inch.

The tubes will be sunk separately or in pairs from scows properly anchored for the purpose or from temporary platforms supported on piling. The greatest care will be exercised to see that they are not overstrained in the handling so as to cause leaks in the joints. When in position to be sunk the tubes will be lowered in a slow and careful manner so as always to be in complete control. The piles in the trench will always be in such positions that one of the diaphragms of the tube will rest upon the beam when the tubes are in place. Each tube or pair of tubes is to be provided with a detachable upright at each end, firmly braced to the tube and of sufficient length to indicate the position of the tube when sinking. These uprights will also serve the purpose after the tube is sunk to adjust its position laterally, so as to bring the sections into alignment. The uprights will, therefore, extend ten feet above the water after the tube is in position. When the tubes are concreted in, these uprights will be removed and used again. When the tubes are adjusted laterally to their correct position divers will examine all bearings of the tubes on the beams in the bottom of the trench and will insert shim plates of proper thickness to produce exact bearings.

Each tube when manufactured will be fitted with a sleeve at one end which can slip over the end of the adjoining tube previously sunk. The sleeve is to be provided with a flange which can be bolted to a corresponding flange of the adjoining tube, a rubber gasket being placed between the two. A similar rubber gasket is to be provided at the inner end of the sleeve bearing up against the edge of the next tube. In bolting up the flanges, which must be done by divers, the rubber gaskets must be squeezed together between the ends of the tubes to form a tight joint. A space three inches by eighteen inches is thus formed all around the tube at the joint. This space will be filled with a grout of pure cement. To this end each sleeve will be provided on top with two small pipes (flexible pipes and joints) leading to the scow floating above. With a force pump each joint will be tested to ascertain whether it is tight by closing one pipe and forcing water through the other. When the joint has been made reasonably tight pure cement grout will be pumped into it through one pipe until it comes out through the other as evidence that it is completely filled.

In order to assist in making an exact connection between the tubes each tube will be provided with two pilot pins with taper points that fit into bell-shaped sockets fastened to the adjoining tube. When the tubes are sunk and pulled into place these pilot pins will guide the tube to its exact position for connecting up. Before each tube or set of tubes is launched the corresponding end of the next tube will be fabricated and all flanges, rubber gaskets, bolts and pilot pins with sockets, fitted together, so that when connected up they will fit accurately.

The ends of the tubes at the joints are further to be fitted with flange angles on the inside for the purpose of caulking between them should the joints be found to leak. These flange angles are then to be connected with bolts drawn up tight and a suitable caulking material forced in between such angles to make the joint tight. These angles will not be connected where the joints are found tight and acceptable.

A wooden form is to be bolted to the outer flanges of the diaphragms of each pair of tubes in order to confine the concrete deposit around the latter. This form is to consist of rough planks of yellow pine, white pine, spruce or other timber, three inches in thickness and eight to twelve inches in width securely bolted to the flanges of the diaphragm with 5/8-inch bolts. The form is to be finished on top with a string piece. In the preparation of the concrete for the tunnel filling it is provided that gravel may be used in place of crushed stone.

In order to enable the contractors to begin lining the tubes before the sections are sunk all the way across the river, some of the tubes may be provided with bulkheads to keep out the water when the tubes laid are being pumped out. Such bulkheads will necessarily be of ample strength to take the full hydrostatic pressure coming upon them.

A common sump for two tubes or a separate sump for each tube will be constructed complete with sump chamber and work incidental thereto.

Michael J. Dady, the New York contractor, has offered his dredging plant for sale. Dady was the lowest bidder for $9,000,000 worth of excavating at Colon under the Panama Canal Commission. These bids were opened at Washington about three months ago, but at the last moment the government decided to do its own dredging. Dady felt that such action was making his plant useless and has offered it for sale. It might be added that this policy on the part of the government in interfering with private enterprise is a very pernicious one.

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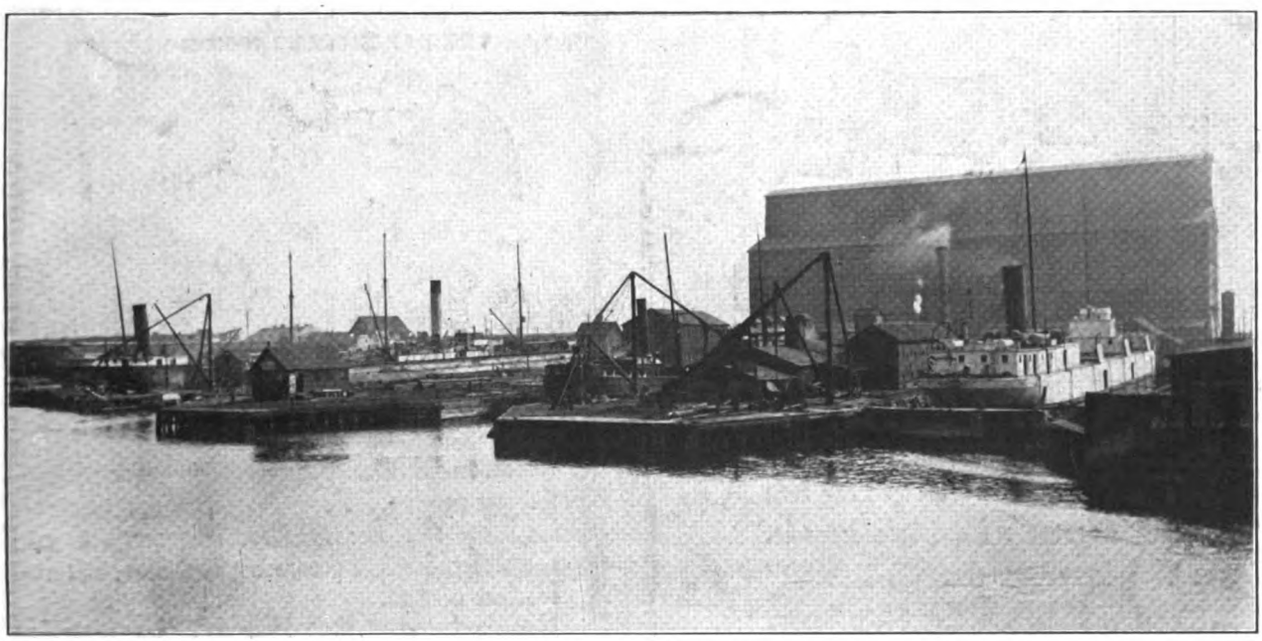

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¶ We call attention to our facilities for the construction of new vessels of all kinds, particularly dredging outfits, tugs, scows, fuel lighters, etc., plans for which we will furnish on application together with specifications and estimates of cost.

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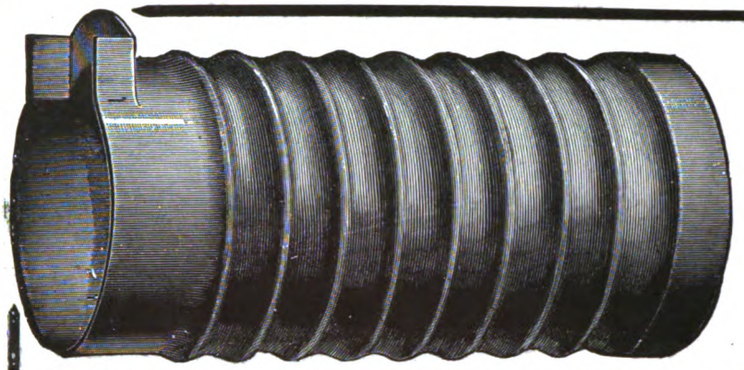

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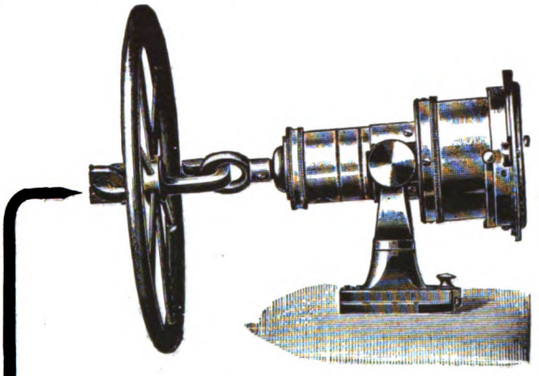

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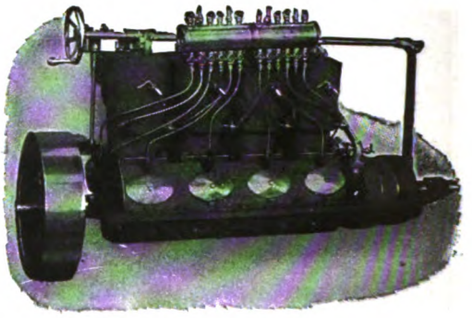

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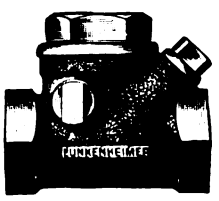

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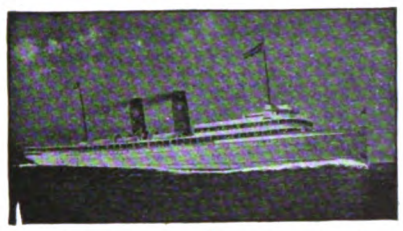

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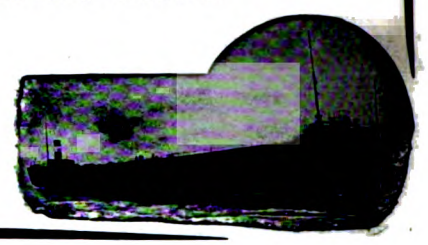

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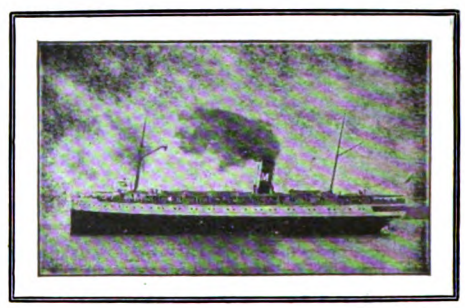

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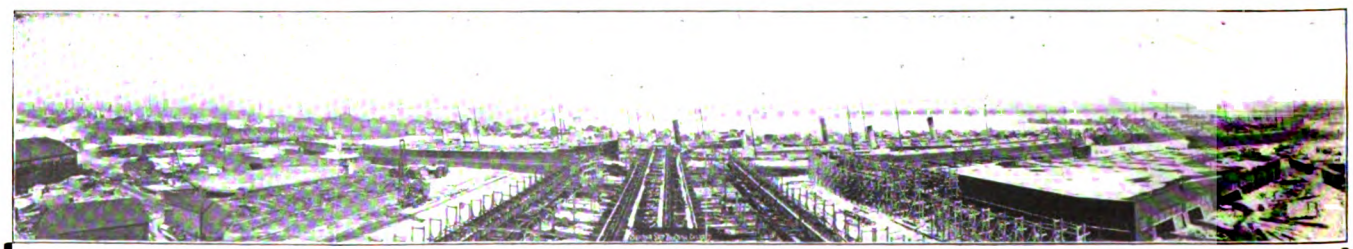

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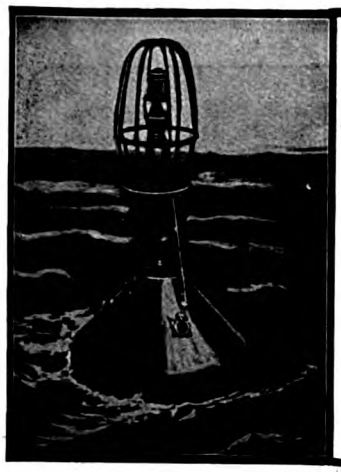

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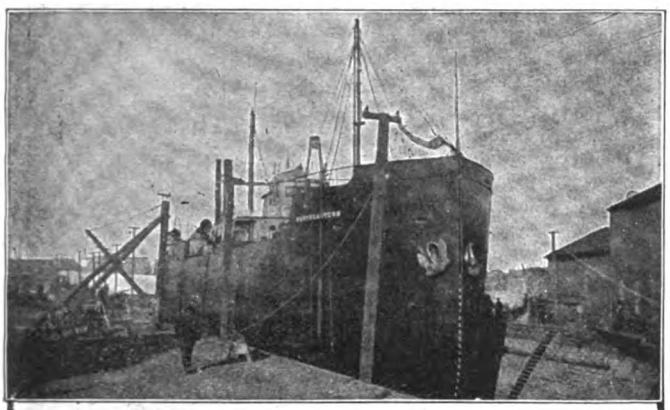

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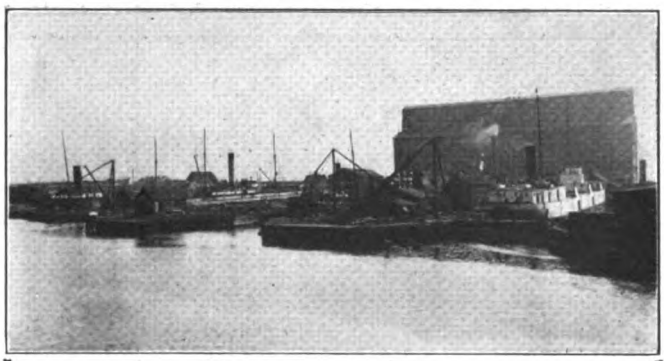

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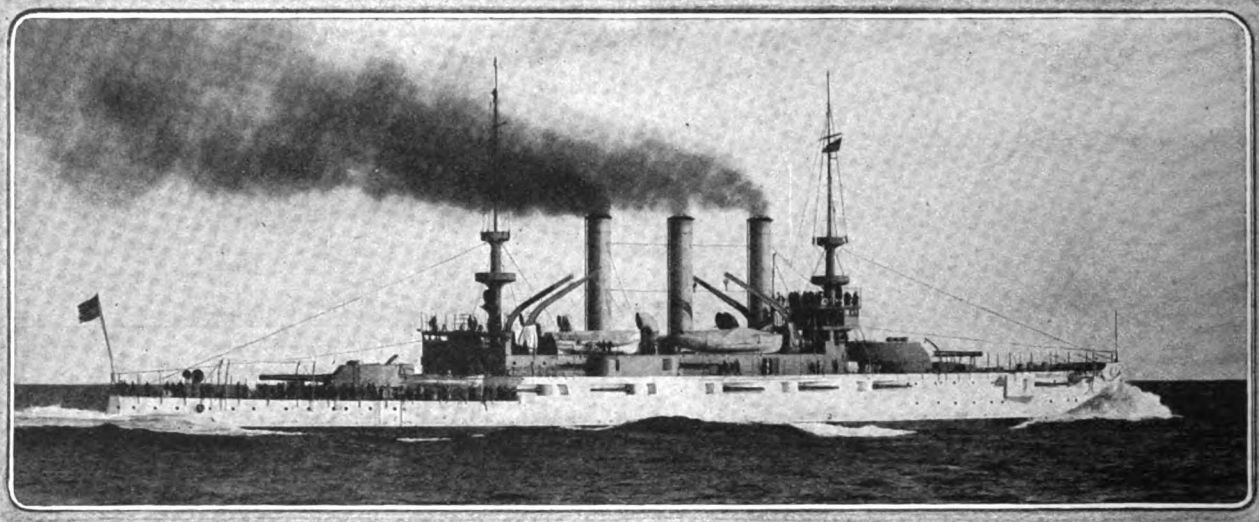

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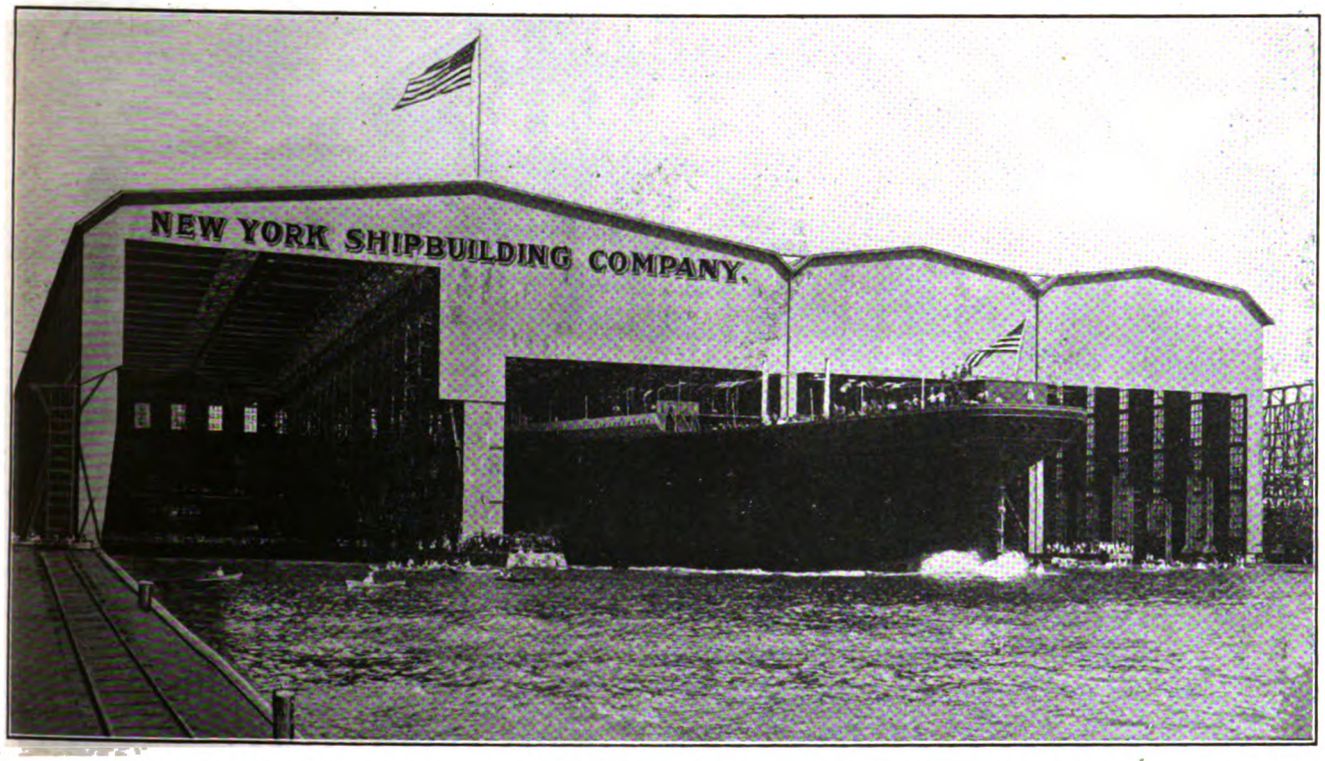

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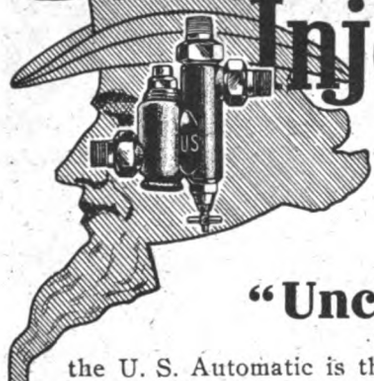

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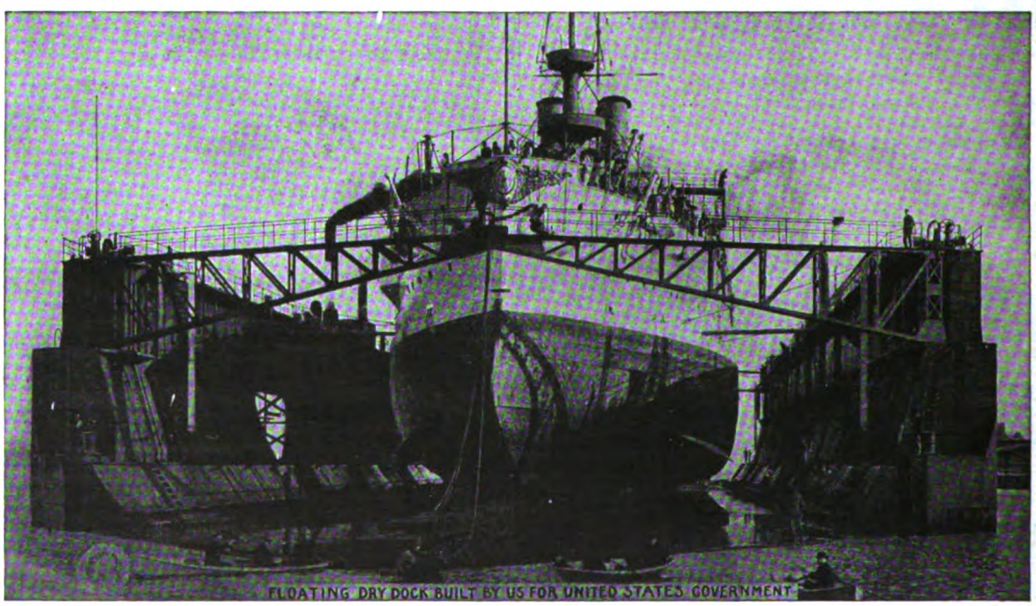

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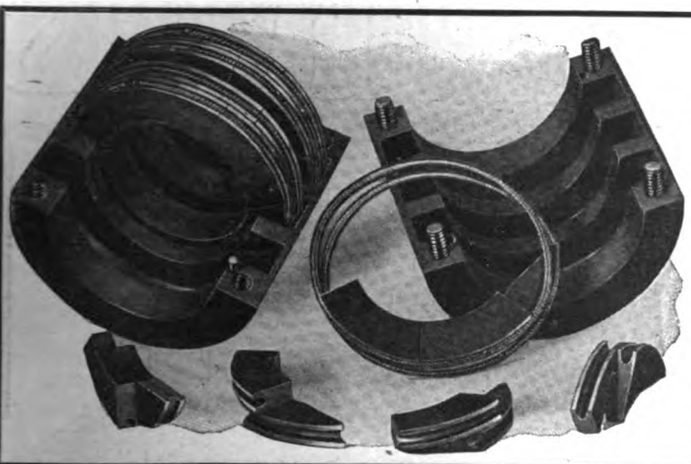

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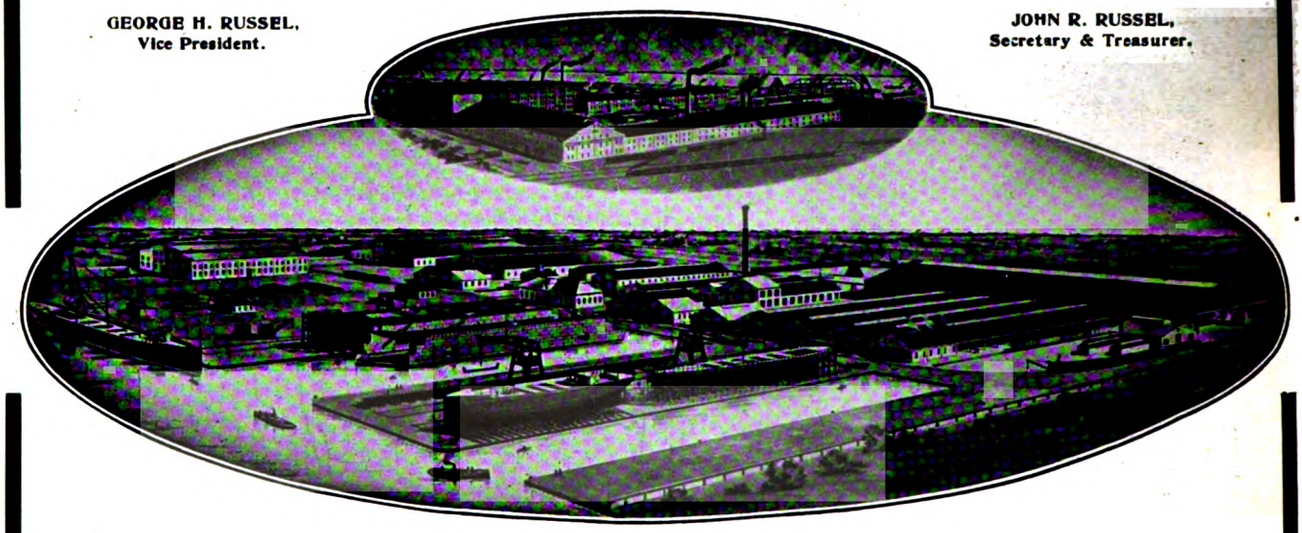

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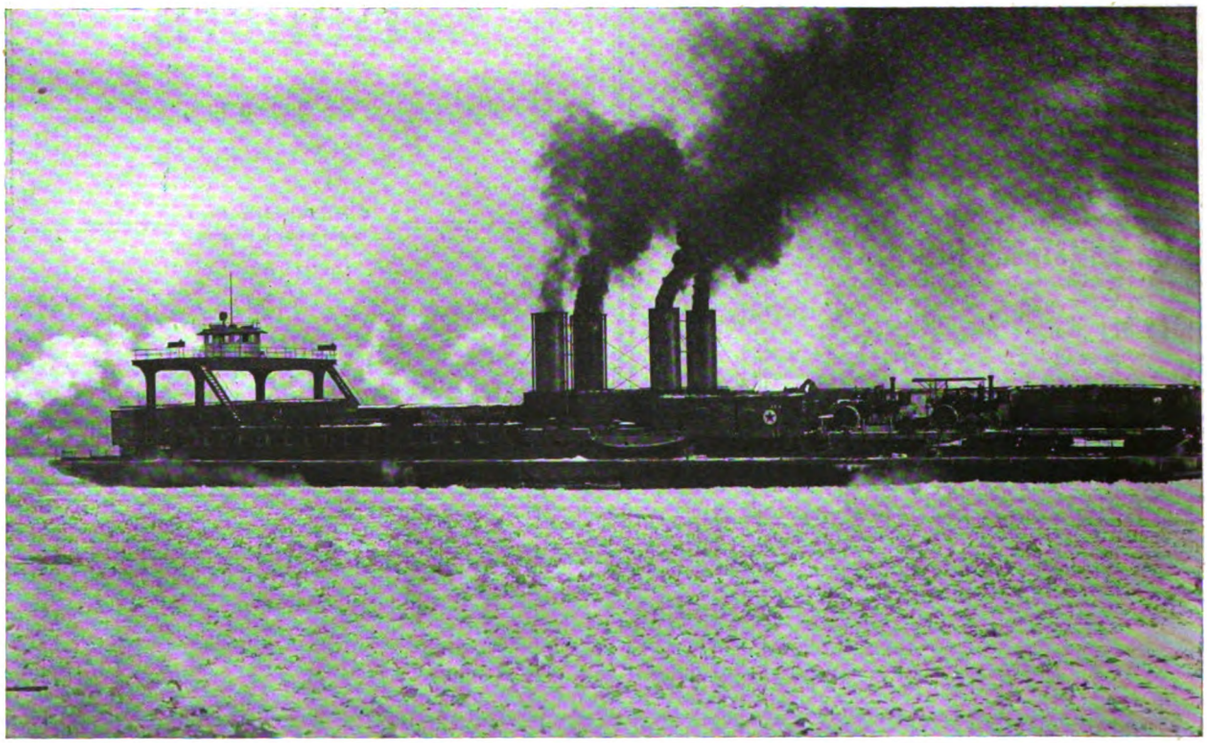

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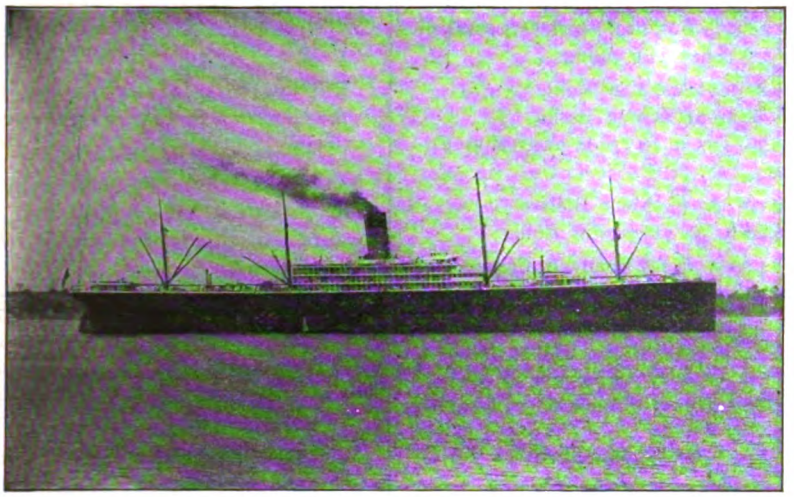
Hyde Windlasses and Capstans



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During its existence the company has insured property to the value of	$21,108,343,494.00
Received premiums thereon to the extent of	224,197,211.06
Paid losses during that period	127,760,071.08
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Of which there have been redeemed	73,744,440.00
Leaving outstanding at present time	7,566,400.00
Interest paid on certificates amounts to	19,469,981.85
On Dec. 31, 1905, the assets of the company amounted to	12,716,427.62

The profits of the company revert to the assured and are divided annually upon the premiums terminated during the year, thereby reducing the cost of insurance.

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One Providence Windlass, 50 fathoms 1½ in. chain.

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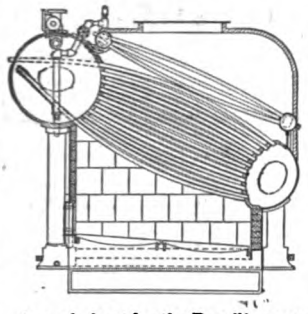
THE MOSHER PATENT WATERTUBE BOILER



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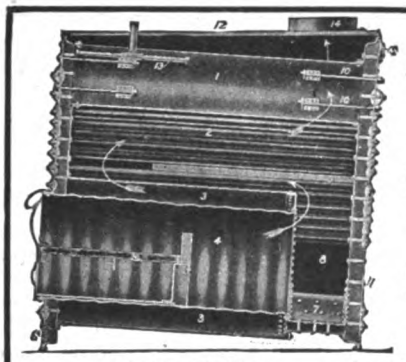

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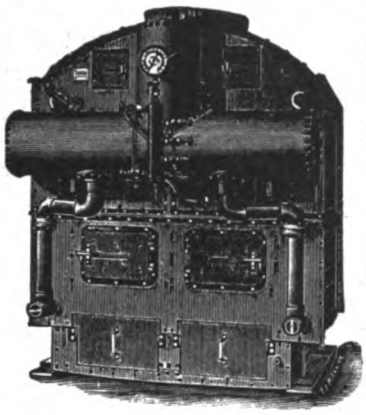

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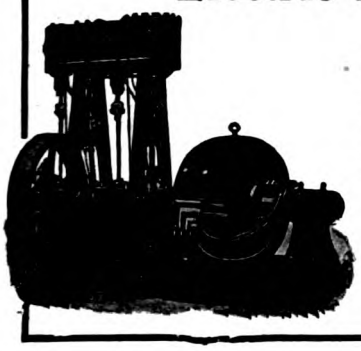

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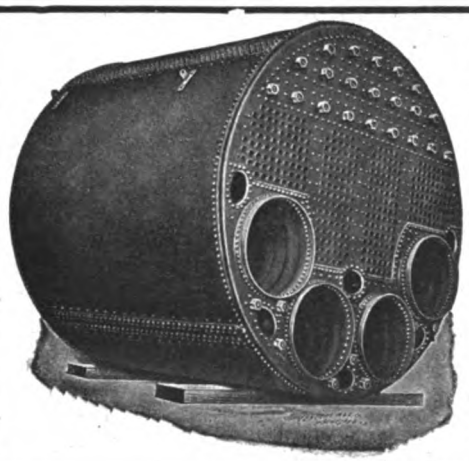

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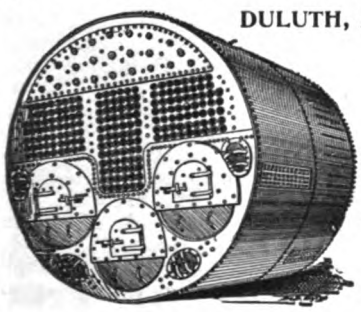

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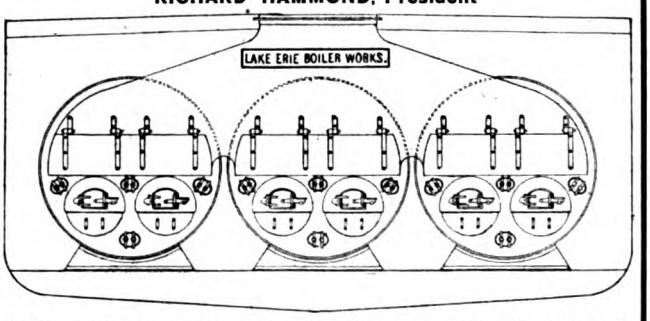

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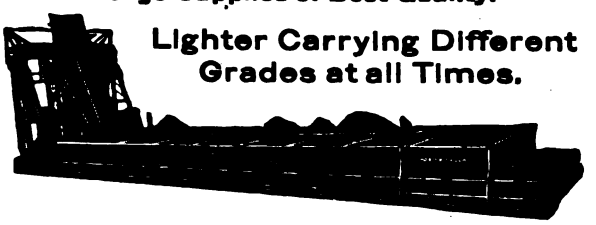

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Buyers' Directory of the Marine Trade.—*Continued.*

CORK JACKETS AND RINGS.
Armstrong Cork Co..Pittsburg, Pa.
Kahnweiler's Sons, D....New York.

CRANES, TRAVELING.
Brown-Hoisting Machinery Co.....
.... Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....
.... Buffalo.
Great Lakes Dredge & Dock Co..
.... Chicago.
Hickler Bros. .....
.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M.....Buffalo.

DREDGING MACHINERY.
Quintard Iron Works Co.New York.

DRY DOCKS.
American Ship Building Co.....
.... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....
.... Chicago
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co.....
.... Detroit
Great Lakes Engineering Works....
.... Detroit.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
....Milwaukee.
Newport News Ship Building Co...
.....Newport News, Va.
Shipowners' Dry Dock Co.Chicago.
Superior Ship Building Co.....
.... Superior, Wis.
Tietjen & Lang Dry Dock Co.....
..... Hoboken, N. J.
Toledo Ship Building Co.....Toledo.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....
..... Manitowoc, Wis.

DYNAMOS.
General Electric Co.....
....Schenectady, N. Y.
Thropp & Sons, John E.....
....Trenton, N. J.

ELECTRIC HOISTS AND CRANES.
General Electric Co.....
.....Schenectady, N. Y.

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co.....
.....Schenectady, N. Y.
Thropp & Sons, John E.....
.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Blower Co., Detroit, Mich.
American Ship Building Co.....
..... Cleveland.
Atlantic Works, East Boston, Mass.
Briggs, Marvin.....New York.
Chicago Ship Building Co., Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons, Philadelphia.
Detroit Ship Building Co., Detroit.
Fletcher, W. & A. Co., Hoboken, N. J.

ENGINE BUILDERS—Continued.
Fore River Shipbuilding Co.....
..... Quincy, Mass.
Great Lakes Engineering Works....
..... Detroit, Mich.
Hall Bros. ..... Philadelphia.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Maryland Steel Co.....
.....Sparrows Point, Md.
Milwaukee Dry Dock Co., Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co....
.....Newport News, Va.
New York Ship Building Co.....
.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Mich.
Quintard Iron Works Co., New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....
..... Superior, Wis.
Thropp, J. E. & Sons Co.....
.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co., New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. ..... Cincinnati.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander ..... Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James ..... Cleveland.
Roelker, H. B.....New York.
Wood, W. J.....Chicago.

FANS.
American Blower Co., Detroit, Mich.

FEED WATER PURIFIERS AND HEATERS.
Ross Valve Co.....Troy, N. Y.
Wheeler Condenser & Engineering Co. ..... New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co....
..... Cleveland.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

FLUE WELDING.
Fix's S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co., Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co., Detroit.
Toledo Fuel Company, ...Toledo, O.

FURNACES FOR BOILERS.
Continental Iron Works, New York

GAS BUOYS.
Safety Car Heating & Lighting Co..
..... New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. ..... Cincinnati.

GAUGES, WATER.
Lunkenheimer Co.....Cincinnati, O.

GENERATING SETS.
General Electric Co.....
.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland.

HEATING AND VENTILATING APPARATUS.
American Blower Co., Detroit, Mich.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....
..... Cleveland.
Brown Hoisting Machinery Co.....
..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
General Electric Co.....New York.
Hyde Windlass Co.....Bath, Me.
Marine Iron Co.....Bay City.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co.....
.....Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works....
.... Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.....
..... New York

ICE MACHINERY.
Great Lakes Engineering Works....
..... Detroit.
Roelker, H. B.....New York.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros.....New York.
Lunkenheimer Co. ..... Cincinnati.
Penberthy Injector Co.....
..... Detroit, Mich.

INSURANCE, MARINE.
Atlantic Mutual Insurance Co.....
.....New York.
Elphicke, C. W. & Co.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A., Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F.....
.....New York and Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

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Milwaukee, - - Wisconsin.

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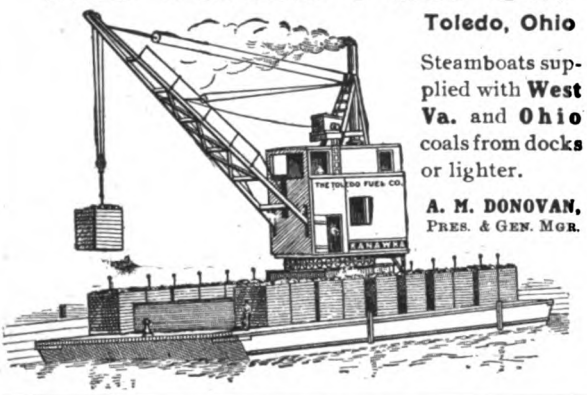
Toledo, Ohio



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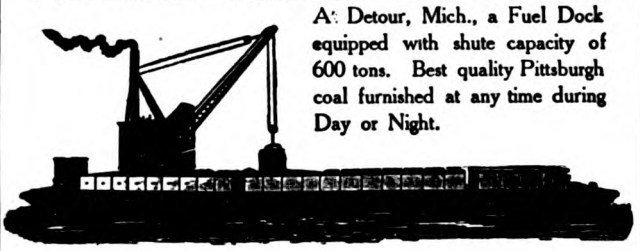

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IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....
.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong Cork Co.....Pittsburg.
Carley Life Float Co.....
.....New York, N. Y.
Drein, Thos. & Son.....
..... Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson.....Buffalo.

LOGS.
Nicholson Ship Log Co., Cleveland.
Walker & Sons, Thomas.....
..... Birmingham, Eng.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ..... Cincinnati.

LUMBER.
Martin-Barriss Co. ..... Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros., Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....
.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc....Philadelphia.

MARINE RAILWAYS.
Hickler Bros., Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....
.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.....
..... Cleveland.
Detroit Ship Building Co., Detroit.
Great Lakes Engineering Works....
..... Detroit.

METALLIC PACKING.
Katzenstein, L. & Co., New York.
The National Metallic Packing Co..
.....Oberlin, O.

MOTORS, GENERATORS—ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Ritchie, E. S., & Sons.....
..... Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander .....Cleveland
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland
Wood, W. J.....Chicago

OAKUM.
Stratford, Oakum Co.....
.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co...New York.
Robertson, Jos. L. & Sons.....
....New York.
The National Metallic Packing Co...
..... Oberlin, O.
Republic Belting & Supply Co.....
.....Cleveland, O.

PAINTS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc. ..Philadelphia.

PILE DRIVING AND SUBMARINE WORK.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....
.... Buffalo.
Great Lakes Dredge & Dock Co....
.... Chicago.
Hickler Bros..Sault Ste. Marie, Mich.
Hubbell Co., H. W...Saginaw, Mich.
Parker Bros. Co., Ltd.....Detroit.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M.....Detroit.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc....Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

PRESSURE REGULATORS.
Ross Valve Co.....Troy, N. Y.

PROPELLER WHEELS.
American Ship Building Co.....
..... Cleveland.
Atlantic Works ..East Boston, Mass.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co....Detroit.
Fore River Shipbuilding Co.....
..... Quincy, Mass.
Great Lakes Engineering Works....
.... Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
....Milwaukee.
Newport News Ship Building Co..
.....Newport News, Va.
Roelker, H. B.....New York.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....
.....Superior, Wis.
Thropp & Sons Co., J. E.....
.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.
Great Lakes Engineering Works..
.... Detroit.
Kingsford Foundry & Machine Works .....Oswego, N. Y.
Wheeler Condenser & Engineering Co. .....New York.
.... Detroit.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland, O.
Great Lakes Engineering Works....

RUBBER SUPPLIES.
Republic Belting & Supply Co.....
..... Cleveland, O

REFRIGERATING APPARATUS.

SAFETY VALVES.
Lunkenheimer Co.....Cincinnati.

SAIL MAKERS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

SALVAGE COMPANIES.
See Wrecking Companies.

SEARCH LIGHTS.
General Electric Co.....
.....Schenectady, N. Y.

SHEARS.
See Punches, and Shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....
..... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Collingwood Shipbuilding Co.,.....
..... Collingwood, Ont.
Cramp, Wm. & Sons..Philadelphia.
Chicago Ship Building Co..Chicago.
Detroit Ship Building Co....Detroit.
Fore River Ship Building Co.....
....Quincy, Mass.
Great Lakes Engineering Works....
....Detroit.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Manitowoc Dry Dock Co.....
.....Manitowoc, Wis.
Maryland Steel Co.....
.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....
..... Milwaukee.
Newport News Ship Building Co...
.....Newport News, Va.
New York Shipbuilding Co.....
.....Camden, N. J.
Roach's Ship Yard.....Chester, Pa.
Shipowner's Dry Dock Co..Chicago.
Toledo Ship Building Co.....Toledo.

SHIP CHANDLERS.
Baker, Howard H. & Co....Buffalo.
Marine Mfg. & Supply Co.....
..... New York
Upson-Walton Co.....Cleveland.

SHIP DESIGNERS.
Kidd, Joseph .....Duluth.
Steel, Nacey, & Hynd....Cleveland.
Wood, W. J.....Chicago.

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Buyers' Directory of the Marine Trade---*Continuea.*

SHIP LANTERNS AND LAMPS.
Upson-Walton Co..... Cleveland.

SHIP TIMBER.
Martin-Barriss Co.....Cleveland.

SIGNALS—SUBMARINE.
Submarine Signal Co.....Boston

SMOOTH-ON COMPOUND, FOR REPAIRS.
Smooth-On Mfg. Co.....
.....Jersey City, N. J.

STAYBOLT IRON OR STEEL BARS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....
.....Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.
Holmes, Samuel .....New York.
McCarthy, T. R.....Montreal, Can.

STEAMSHIP LINES, PASS, AND FREIGHT.
American Line .....New York.
Anchor Line .....Buffalo.
Boston Steamship .....Boston.
C. & B. Transit Co.....Cleveland.
International Mercantile Marine Co.
.... Philadelphia.
Mallory Line .....New York.
New York & Cuba Mail S. S. Co..
....New York.
Red Star Line .....New York.

STEAM SPECIALTIES.
Robertson, Jas. L. & Sons ..New York.

STEEL CASTINGS.
Otis Steel Co.....Cleveland.

STEERING APPARATUS.
American Ship Building Co.....
....Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
Detroit Ship Building Co....Detroit.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....
....New York.
Sheriffs Mfg. Co.....Wilwaukee.

SUBMARINE DIVING APPARATUS.
Morse & Son, A. J.....Boston.
Schrader's Son, Inc. A....New York.

SURVEYORS, MARINE.
Hynd, Alexander .....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Nacey, James .....Cleveland.
Steel, Adam .....Cleveland.
Wood, W. J.....Chicago.

TESTS OF MATERIALS.
Hunt, Robert W. & Co....Chicago.
Lunkenheimer Co....Cincinnati, O.

THERMIT
Goldschmidt Thermit Co.,
..... New York City.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Watson-Stillman Co.....New York.

TOOLS, WOOD WORKING.
Atlantic Works, Inc....Philadelphia.

TOWING MACHINES.
American Ship Windlass Co.....
.....Providence, R. I.
Chase Machine Co.....Cleveland

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co..
.....Kingston, Ont.
Great Lakes Towing Co..Cleveland.

TRUCKS.
Boston & Lockport Block Co.....
..... Boston.

TUBING, SEAMLESS.
Shelby Steel Tube Co..Pittsburg, Pa.

VALVES, STEAM SPECIALTIES, ETC.
Jenkins Bros. .....New York
Lunkenheimer Co.....Cincinnati.
Ross Valve Co.....Troy, N. Y.

VALVES FOR WATER AND GAS.
Ashton Valve Co.,.....Boston.
Lunkenheimer Co.....Cincinnati.
Republic Belting & Supply Co.....
....Cleveland, O.
Ross Valve Co.....Troy, N. Y.
Scoville Check Valve Co.....
..... Ashtabula, O.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Douglas, G. L. Jr.....Duluth
Elphicke, C. W. & Co.....Chicago.
Hall, John B.....Buffalo.
Helm & Co., D. T.....Duluth.
Hawgood & Co., W. A....Cleveland.
Holmes, Samuel .....New York.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.

VESSELS AND FREIGHT AGENTS—Con.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago

WATER GAUGES.
Lunkenheimer Co.....Cincinnati, O.

WHISTLES, STEAM.
Lunkenheimer Co.....Cincinnati.

WILFORD'S WATERPROOF CLOTH.
Bunker, E. A..... New York.

WIRE ROPE AND WIRE ROPE FITTINGS.
Baker, H. H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

WINDLASSES.
American Ship Windlass Co.....
..... Providence, R. I.
American Ship Building Co.....
..... .Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....
....New York.

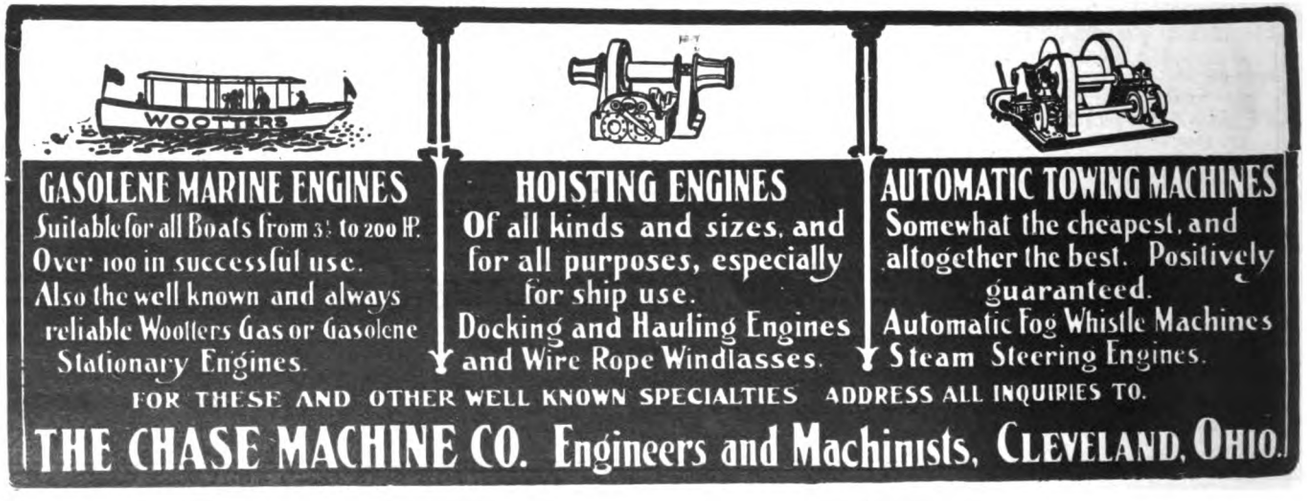
WINCHES.
American Ship Windlass Co.....
.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Atlantic Works, Inc....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co..
..... Kingston, Ont.
Great Lakes Towing Co..Cleveland.
Parker Bros. Co., Ltd.....Detroit.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....
..... Wilmington, Del.
Manitowoc Dry Dock Co.....
..... Manitowoc, Wis.
Truscott Boat Mfg. Co.....
.....St. Joseph, Mich.

YAWLS.
Drein, Thos. & Son.....
..... .Wilmington, Del.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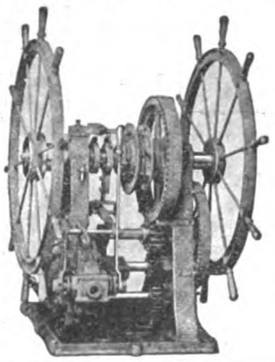

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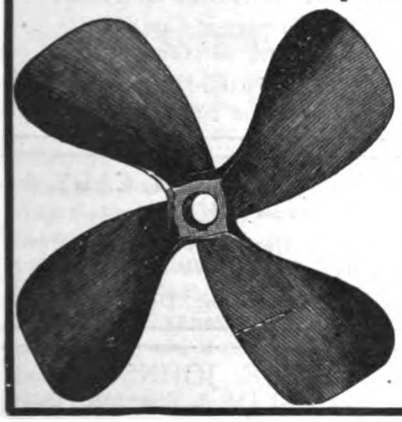

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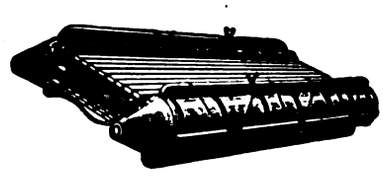

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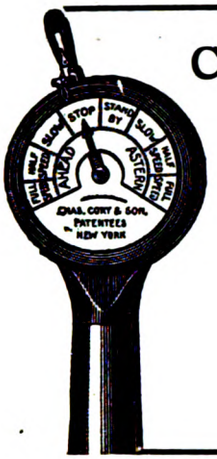

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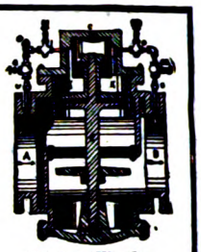

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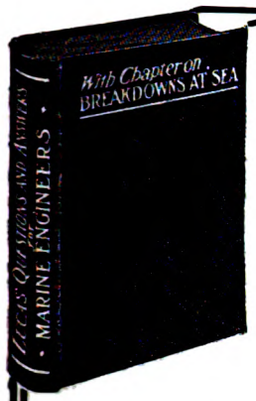

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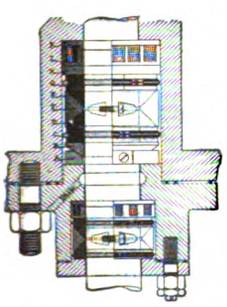

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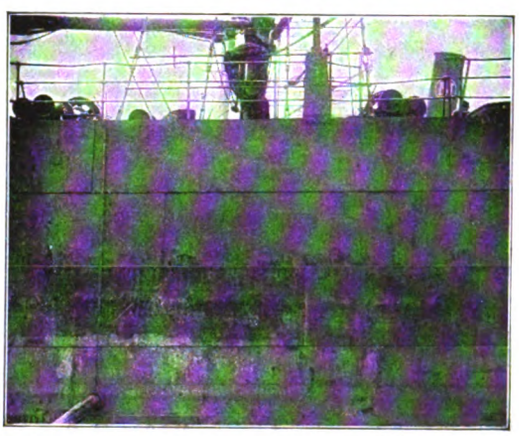

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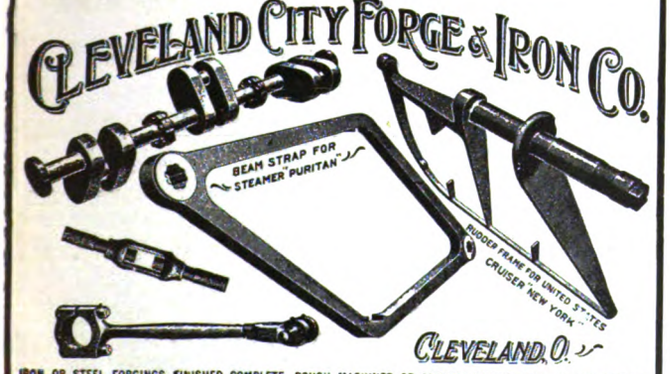

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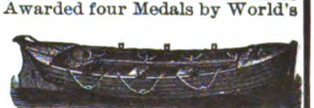

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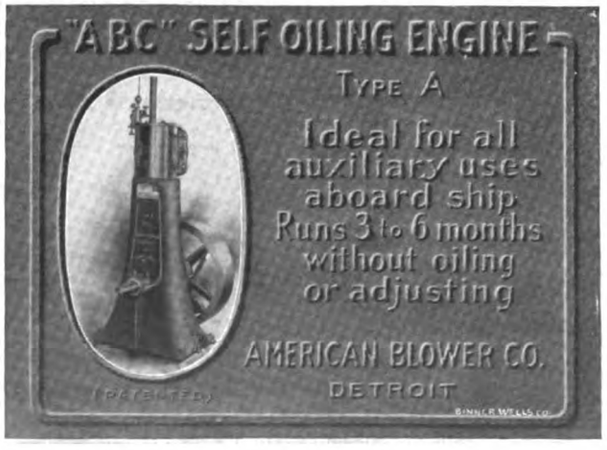
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